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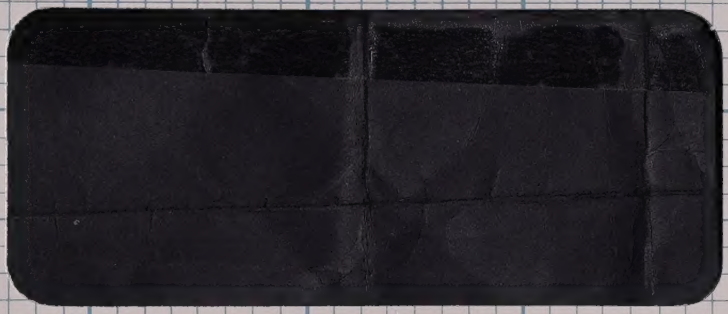

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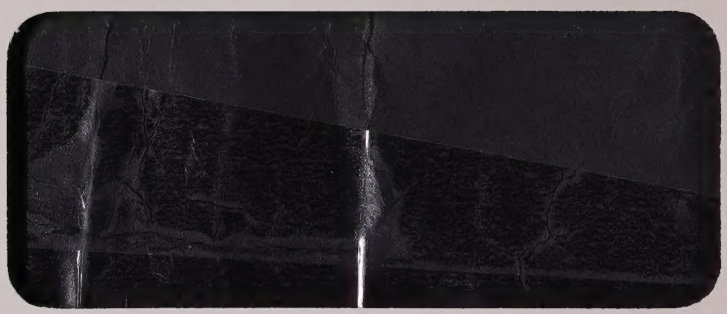

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INSTRUCTION MANUAL
FOR
TYPES SM-1621 AND SM-1622
SIGNAL MONITORS

WATKINS—JOHNSON COMPANY
700 Quince Orchard Road
Gaithersburg, Maryland 20878

WJ/200/9/79

WARNING

This equipment employs voltages which are dangerous and may be fatal if contacted. Extreme caution should be exercised in working with the equipment with any of the protective covers removed.

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Table 1-1. Types SM-1621 and SM-1622 Signal Monitors, Specifications

Number of Inputs	One, type BNC connector
Input Center Frequency	160 MHz
Input Impedance	50 ohms
Sweep Width	20 MHz, maximum
Sweep Rate	5 Hz to 25 Hz, nominal, continuously variable
Sweep Linearity	Linear overall to within 5% of the total sweep width
Intermediate Frequency	21.4 MHz
Local Oscillator Frequency	181.4 MHz, ±1/2 sweep width
Resolution	200 kHz, nominal
Image Rejection	40 dB, minimum
IF Rejection	60 dB, minimum
Sensitivity	10 μV input produces at least one-inch deflection on the CRT
Outputs, BNC Connectors:	
Vertical	1V P-P, nominal into 100 kΩ
Horizontal	20V P-P, nominal into 100 kΩ
Gain Control Range	60 dB, minimum
Crystal Marker:	
Frequency	160 MHz
Tolerance	±0.01%
CRT Display	Type 3ASP1
Power Input	115/230 Vac, 50-400 Hz
Power Consumption	15 watts, approximately
Dimensions:	
SM-1621	3.5 inches high, 19 inches wide, and 15.5 inches deep
SM-1622	3.25 inches high, 7.9 inches wide, and 15.5 inches deep
Weight:	
SM-1621	14 lbs., approximately
SM-1622	11 lbs., approximately

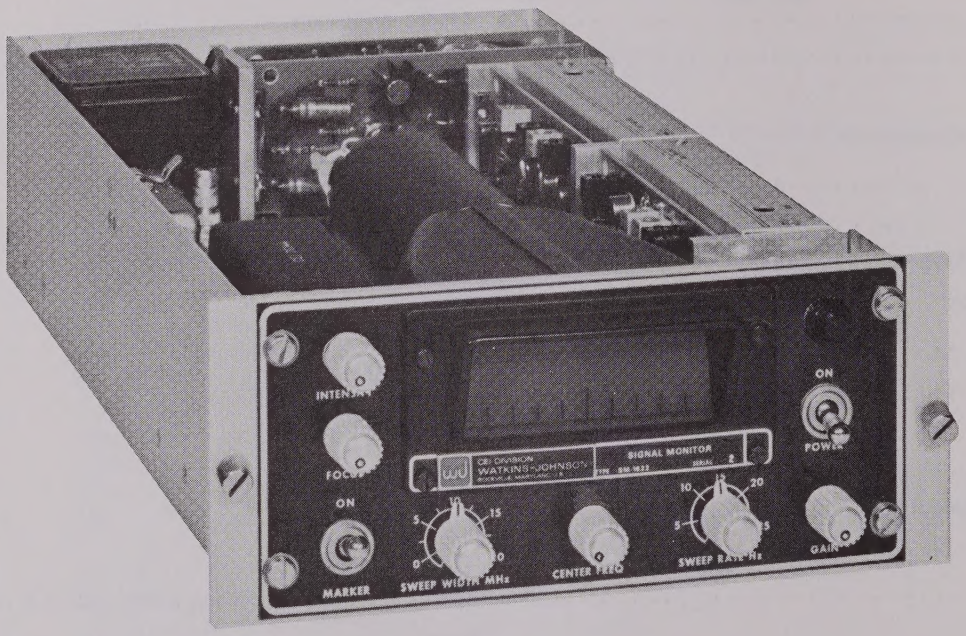


Figure 1-1. Type SM-1622 Signal Monitor, Front View

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

1.1.1 The Types SM-1621 and SM-1622 Signal Monitors are designed to receive 160-MHz IF signals from an associated receiver. The signal monitors provide a visual display of signals within the spectrum centered about 160 MHz up to a maximum of 20 MHz bandwidth. The signal monitor, in effect, shows the equipment operator all signal activity within the passband of his receiver up to a maximum of ±10 MHz from the receiver's tuned frequency. A continuously variable sweep rate from 5 Hz to 25 Hz allows adjustment for optimum resolution of the displayed signals. A SWEEP WIDTH control is provided which allows the operator to compress or expand the visual display for wide bandwidth monitoring, or analysis of specific signals. A 160 MHz marker generator is included to indicate the center of the displayed spectrum.

1.1.2 Both signal monitors provide horizontal and vertical outputs at the rear panel for operation of additional display devices. A rear panel switch allows control of the RF sweep direction so that the signal monitors can be used with receivers having either high beat or low beat first local oscillators. Pertinent electrical and mechanical specifications are provided in Table 1-1. The SM-1621 and SM-1622 are electrically identical.

1.2 MECHANICAL CHARACTERISTICS

1.2.1 The SM-1621 is constructed for mounting in a standard 19 inch rack while the SM-1622 is designed for half-rack mounting. A Type EF-201C Equipment Frame can be used which allows mounting of two SM-1622 Signal Monitors in 3.5 inches of vertical rack space.

1.2.2 The main chassis and front panel of both signal monitors are constructed of aluminum. Front panels are finished with gray enamel and overlaid with black anodized bezels etched with control markings. Front panel controls include: POWER switch, GAIN, SWEEP RATE, CENTER FREQ, SWEEP WIDTH, MARKER switch, FOCUS, and INTENSITY. In addition, an indicator lamp shows power on. Subassemblies of the signal monitors are constructed on printed circuit boards either as plug-in units or permanently mounted in brass chassis. The brass chassis have been plated with precious metals to increase conductivity and durability. A metal shield encloses the CRT display device to prevent trace distortion by stray magnetic fields. The rear panel of both signal monitors mounts the following BNC connectors: 160 MHz INPUT jack J1, VERT OUTPUT J2, and HORIZ OUTPUT J3. Also located on the rear panel are SWEEP switch S3, primary power selector switch S4, protective fuses F1 and F2, and the permanently attached power cord.

1.3 EQUIPMENT SUPPLIED

This equipment consists of the Type SM-1621 or SM-1622 Signal Monitor with maintenance and alignment tools mounted on the main chassis only. Dimensions and weight are given in Table 1-1.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The signal monitors are designed to operate with receivers or tuners having a 160 MHz first IF and up to 20 MHz bandwidth.

SECTION II

CIRCUIT DESCRIPTION

2.1 GENERAL

Operation of the various circuits in the SM-1621 and SM-1622 Signal Monitors is described in the following paragraphs using the functional block diagram, Figure 2-1, and schematic diagrams Figures 6-1 through 6-11 located at the rear of this manual. Since the SM-1621 and SM-1622 are electrically identical, only the SM-1622 will be discussed and illustrated. Note that the unit numbering system is used for identification of electrical components. This means that parts on subassemblies and modules carry a prefix before the usual class letter and number of the item such as A7R1. In this example, A7 identifies the subassembly and R1 identifies the specific component. These prefixes are omitted on illustrations and in the text except in those cases where confusion might result from their omission.

2.2 FUNCTIONAL DESCRIPTION

Figure 2-1 illustrates the function of subassemblies and major components in the SM-1622.

2.2.1 160 MHz Tuner (A3). - Input signals are applied to jack J1 which connects to 160 MHz tuner A3. In A3 the signals pass through a low pass filter and series tuned image trap before amplification by Q1 and Q2. The low pass filter has a cut off frequency of 170 MHz and aids in the rejection of image frequency signals. Transistors Q1 and Q2 have their outputs sweep tuned by voltage tuned tank circuits over the 150-170 MHz range. The gain of both stages is controlled by a front panel GAIN control. The 150-170 MHz output from Q2 is applied to balanced mixer U1 which produces a 21.4 MHz output signal. The local oscillator signal for U1 is developed by Q5 and buffered by Q3. The output frequency from Q5 is controlled by another sweep voltage tuned tank circuit which tunes Q5 simultaneously with Q1 and Q2. Sweep oscillator Q5 operates 21.4 MHz above the receiver IF frequency ±1/2 sweep width and thus has a range of 171.4 to 191.4 MHz. The same basic sawtooth waveform is used to sweep the 160 MHz tuner and the CRT display which provides synchronization between the signals displayed on the CRT and their original position in the associated receiver's IF spectrum. The difference frequency output from U1 is amplified by Q4. The gain of Q4 is adjustable to provide the proper level to the circuits which follow A3. Module A3 also contains subassembly A1 which is a crystal controlled 160 MHz oscillator. Output signals from A3A1 are also injected into balanced mixer U1 to provide a center frequency marker on the CRT display. The oscillator is controlled by front panel MARKER switch, S2.

2.2.2 Bandpass Filter (A9). - The 21.4 MHz output from A3 is applied to module A9 which determines the maximum resolution for the signal monitor. The filter has a 200 kHz bandwidth at the 3 dB points.

2.2.3 IF Amplifier (A6). - From the bandpass filter, the 21.4 MHz signal is amplified by Q1 through Q3 in module A6. Each stage is tuned to 21.4 MHz and provides additional selectivity for the 21.4 MHz signal. The gain of Q1 is adjustable to provide the desired drive level to the output amplifier module which follows.

2.2.4 Output Amplifier (A7). - This module provides amplification with cascode stage Q1-Q2 which drives three demodulators to provide balanced video output to the CRT vertical deflection plates and auxiliary video output. In addition, the vertical position control for the CRT is located in A7.

2.2.5 Sweep Generator (A8). - This module develops the sawtooth waveforms which provide horizontal sweep for the display CRT and, after shaping, tuning voltage for tuner A3. In addition, the video amplifier driving the rear panel vertical output jack, J2, is located here. Video from the auxiliary video detector in A7 is amplified by A8U5 and the output drives vertical output jack J2. Transistor Q1 is a uni-junction device which generates the basic sawtooth waveform. The repetition rate of the sawtooth waveform developed by Q1 is controlled by a current source, Q2. The current supplied by Q2 is controlled by a voltage divider consisting of components on module A4 and a front panel SWEEP RATE control. The sawtooth waveform generated by Q1 is buffered by unity gain amplifier U1 which isolates the oscillator from the circuits which follow. From U1, the sawtooth output is applied to horizontal amplifier circuits in A4 to drive the CRT horizontal plates, and to amplifier U2. Amplifier U2 shifts the sawtooth waveform level so that the waveform begins at +10V and ends at -10V. The level shift is controlled by a bias voltage applied to the non-inverting input. The input sawtooth is applied to the inverting input of the

stage and the sweep calibrate control determines the stage gain. From U2, three outputs are provided. One output is used as the negative sweep voltage output. This voltage also drives U3 and U4. Both U3 and U4 provide inversion of the input waveform. The output of U3 is the positive sweep voltage output and the output of U4 provides the horizontal output at rear panel jack J3.

2.2.6 Horizontal Amplifier (A4). - This module contains the horizontal amplifier circuit which drives the CRT horizontal deflection plates, the shaping network for the tuning voltage applied to A3, and various other circuit components. The horizontal sweep voltage is applied through a width control to emitter follower Q1. Emitter follower Q1 drives Q2 and one half of differential amplifier Q3-Q4. The other half of the differential amplifier is controlled by a horizontal position control which also controls the conduction of emitter follower Q5. Note that the differential amplifier drive from Q2 and Q5 is cross coupled. This means that each half of the differential amplifier is controlled by the horizontal sweep sawtooth input and the horizontal position control. The output voltages from the differential amplifier are 180° out of phase with each other and translated in level to provide the CRT horizontal deflection plate drive.

2.2.6.1 Several other components are located on the horizontal amplifier module. Anode voltage for the CRT is derived from a voltage divider which receives +200 volts from PS1. In addition, circuits which supply tuning voltage to the tuning networks in A3 and provide the marker level adjustment are located here. Rear panel SWEEP switch, S3, supplies either positive or negative sweep voltage to a front panel SWEEP WIDTH control. From the arm of this control, the sawtooth voltage is applied to a shaping network located in A4. This network shapes the linear sawtooth waveform and provides an output waveform which will provide linear tuning from 150-170 MHz by tuner subassembly A3. A Zener diode regulated voltage source in A4 is connected to the front panel CENTER FREQ control. From the arm of this control, the voltage is then applied to the tuning networks in A3. This voltage sets the center frequency of the RF sweep. An additional voltage divider which includes a marker level potentiometer in A4 supplies voltage through front panel MARKER switch, S2, to the 160 MHz marker oscillator A4A1 to vary the center frequency marker level.

2.2.7 Focus and Intensity (A5). - This board mounts the intensity and focus controls. It provides a voltage divider which sets the proper CRT element voltages. Input voltage is from dc-to-dc converter module PS1 which supplies approximately -1500 Vdc to the board.

2.2.8 -18 Volt Regulated Power Supply (A1). - This module receives ac input from main chassis power transformer T1. A full-wave rectifier and filter consisting of diode module CR1 and capacitor C1 supply dc input to the regulator circuit. Diodes CR2 and CR3 supply the voltage reference to cascaded emitter followers Q2 and Q1.

2.2.9 +18 Volt and +24 Volt Regulated Power Supply (A2). - Module A2 provides two regulated output voltages, +18 and +24 volts. Diode module CR1 and capacitor C1 provide dc input to series regulator Q1 which supplies the +24 volt output. Conduction of Q1 is controlled by a differential error amplifier, Q3-Q4, through emitter follower Q2. A reference voltage source for the differential amplifier is provided by CR2-CR3. Input voltage for the other side of the error amplifier is taken from the voltage set potentiometer in a voltage divider circuit from the regulator output. The +24 volt output is further regulated to provide +18 volts by Q5 and its reference voltage source, CR4-CR5.

2.3 TYPE 76168 -18V REGULATED POWER SUPPLY

Figure 6-1 is the schematic diagram for this module; its reference designation prefix is A1. Diode module CR1 provides full-wave rectification of the ac input from main chassis power transformer, T1. Capacitor C1 provides initial filtering of the pulsating dc from the rectifier. Cascaded emitter followers Q1 and Q2 in conjunction with Zener diode CR2 form the regulator circuit. Diode CR3 is included for temperature compensation. The regulated output voltage is taken from the emitter of Q1. Zener diode CR2 functions as a parallel voltage regulator with the required load current supplied by Q2 and Q1.

2.4 TYPE 76166 +18V AND +24V REGULATED POWER SUPPLY

The schematic diagram for the Type 76166 Regulated Power Supply is Figure 6-2; its reference designation prefix is A2. Transistor Q1 functions as a series regulator whose conduction is controlled by emitter follower Q2. Transistors Q3 and Q4 are connected as a differential amplifier which amplifies any difference in the voltage at their bases. The base voltage of Q4 is fixed by Zener diode CR2. The base of Q3 is connected to the regulated

output through a sampling voltage divider made up of R6, R7, and R8. Any fluctuation in the output voltage is amplified and inverted by Q3, and applied to the base of the series regulator through emitter follower Q2. If, for example, the output voltage tends to rise, Q3 conducts harder, causing the voltage drop across R2 and R3 to increase. This lowers the bias voltage of emitter follower Q2, which is reflected through to series regulator Q1. As a result, the base of Q1 goes more negative, increasing its collector-to-emitter impedance so that the output voltage returns to its nominal value. A differential amplifier is used in the comparison circuit as the base-emitter variations with temperature changes in one transistor tend to cancel changes in the other. Additional temperature compensation is provided by CR3. An emitter follower is necessary to amplify the low-current output of Q3 to provide sufficient current drive for the low-impedance base input of Q1. Resistor R4 connects the base of Q3 to the input side of the regulator so that ac hum voltage at this point can be cancelled out. The +24V output is taken from the emitter of Q1. The +18V output is taken from the emitter of transistor Q5. Zener diode CR4 establishes the +18V reference while CR5 compensates for fluctuations in the emitter-to-base voltage drop across Q5 caused by temperature variations.

2.5 TYPE 71290 160-MHz TUNER

Figure 6-3 is the schematic diagram for the 160-MHz tuner; its reference designation prefix is A3.

2.5.1 RF Amplifiers. - Input signals are applied to jack, J1, and are filtered by a lowpass filter consisting of L4 and the input capacity of Q1. The filter is adjusted to roll off at 170 MHz. Inductor L7 and C2 form an image trap tuned to 201.4 MHz. Capacitor C4 couples the filter output to amplifier Q1 through ferrite bead FB1. The ferrite bead functions as a parasitic suppressor to stabilize the stage. Bias for gate 1 (pin 3) of the IGFET (insulated gate field effect transistor) is developed by voltage divider R4-R5. Gain control voltage is applied to gate 2 (pin 2) through R6. Capacitor C7 holds gate 2 at RF ground. Self bias for the stage is developed across R7 and C10 is the source resistor bypass. The drain of Q1 is resonated by a voltage tuned tank circuit consisting of C13, L2, C14, and varactor diode CR2. Inductor L1 is an RF choke to supply drain voltage to Q1. Resistor R8 is an additional parasitic suppressor for the stage. Capacitor C12 is a dc blocking capacitor and provides coupling between Q1 and its tank circuit. Trimmer C13 is the band set capacitor for the tank and the varactor diode is used to voltage tune the tank. Initial reverse bias for the varactor is taken from the arm of the CENTER FREQ front panel control and coupled to the diode through R10. Tuning voltage (sawtooth) is applied to the varactor through R1, R3, R9, and R11. Capacitor C15 holds the anode of the varactor at RF ground, and C14 couples the varactor into the tank circuit. Capacitor C16 lightly couples the output of Q1 to Q2. Amplifier Q2 is functionally identical to Q1. Output from the tank circuit of Q2 is taken from the tap of T3 which provides impedance matching for the RF signal input to balanced mixer U1.

2.5.2 Oscillator Buffer. - Transistor Q5 is the voltage tuned oscillator for the 160 MHz tuner. Base bias is taken from the junction of R34 and R35, and the emitter current is set by R38. Capacitors C43 and C44 provide an impedance step up and regenerative feedback for the oscillator. The voltage tuned tank circuit consists of T1, C36, C34, and varactor CR4. The oscillator tunes from 171.4 to 191.4 MHz (21.4 MHz above 160 MHz ± 1/2 sweep width). This signal is coupled through C31 to the base of buffer amplifier Q3. Transistor Q3 functions as a common emitter amplifier and it is broadly tuned to the oscillator center frequency. Output from the buffer is taken from the center tap of T2 and coupled through C24 to mixer U1.

2.5.3 Balanced Mixer and 21.4 MHz Amplifier. - Integrated circuit U1 is a balanced mixer. It provides sum and difference of its input frequencies as outputs. The RF and LO signals are suppressed at the mixer output (pin 4). An additional RF input signal is applied to the mixer when the 160 MHz marker oscillator (A3A1) is activated. This signal provides a center frequency marker on the SM-1622 display CRT. A parallel tuned circuit consisting of C49 and L6 is resonant at the 21.4 MHz mixer difference frequency. Resistor R28 and C23 couple the 21.4 MHz signal to Q4. Transistor Q4 functions as a neutralized common emitter amplifier. Its collector is tuned by T4, C41, and C42. Feedback to neutralize the stage is coupled back to the base through C50. Gain of the stage is controlled by the setting of R33 which determines the effectiveness of emitter bypass C39.

2.6 TYPE 8307 160-MHz MARKER OSCILLATOR

Figure 6-4 is the schematic diagram for the marker oscillator; its reference designation prefix is A3A1. Operating voltage for the oscillator is applied through feedthrough capacitor C1. This voltage comes from a voltage divider located in module A4 after passing through front panel MARKER switch, S2. Base bias is taken from the junction of R2 and R4. Capacitor C2 holds the bias at RF ground. Emitter current through Q1 is set by R6. The collector circuit is broadly resonated at 160 MHz by L1, C3, and R7. Feedback to sustain oscillation is fed

back to the emitter through crystal Y1. Output from the oscillator is taken from voltage divider capacitors C5-C6.

2.7 TYPE 8241 HORIZONTAL AMPLIFIER

Figure 6-5 is the schematic diagram; the reference designation prefix is A4. As described in paragraph 2.2.6, this module contains the horizontal amplifier circuit which drives the CRT horizontal deflection plates, the shaping network for the tuning voltage applied to A3, and various other circuit components.

2.7.1 Horizontal Amplifier. - Transistors Q1 through Q5 form the horizontal amplifier circuit. The horizontal amplifier circuit. The horizontal sweep input is applied through module pin 21 to potentiometer R3. From the arm of R3 the sweep voltage is applied directly to the base of emitter follower Q1 which drives Q2 and Q3. Transistor Q2 is an emitter follower driving the emitter of Q4 through R10. Transistors Q3 and Q4 form a differential amplifier. High voltage transistors are used to provide the necessary voltage drive to the CRT horizontal deflection plates. Note that both sides of the differential amplifier are dc coupled to two input sources. The sawtooth (horizontal sweep) voltage is applied directly to the base of Q3 from Q1 and to the emitter of Q4 after passing through emitter follower Q2. A horizontal position voltage is also applied to both sides of the differential amplifier. This voltage is taken from the arm of R18, applied to the base of Q4 through R15, and after passing through emitter follower Q5 is applied to the emitter of Q3. This circuit arrangement makes it possible to vary the horizontal position control without changing the gain of the differential amplifier.

2.7.1.1 During the positive-going ramp of the sawtooth input, Q1, Q2, and Q3 conduct harder. This causes increased drop across R8, the collector load for Q3, and the voltage at module pin 20 swings negative. Simultaneously, the positive-going sawtooth voltage at the emitter of Q2 is applied to the emitter of Q4 through R10. This voltage causes Q4 to conduct less and its collector voltage swings positive since the base voltage on Q4 is held constant. With the collector voltages of Q4 high and Q3 low, the CRT beam is attracted to the deflection plate connected to the collector of Q4 through module pin 17. Retrace of the beam occurs on the trailing edge of the sawtooth when the sawtooth input swings rapidly negative. This causes the collector voltage of Q3 to rapidly swing positive attracting the CRT beam back to the plate connected to Q3. By adjusting R18, the horizontal position of the sweep trace can be changed. This control determines the quiescent current through Q3 and Q4, and thus the no-signal voltage on the CRT horizontal deflection plates. Assuming that R18 is rotated in the clockwise direction, the voltage on the bases of Q4 and Q5 goes more positive causing both transistors to conduct harder. This causes the collector voltage of Q4 to decrease and the emitter voltage of Q5 to swing positive. The positive voltage swing is coupled through R9 to the emitter of Q3 causing it to conduct less. The result is an increase in its collector voltage and the CRT beam is attracted to the plate connected to Q3. If R18 is rotated in the counterclockwise direction, the opposite effect occurs. In that case, the sweep trace shifts in the direction of the deflection plate connected to Q4. Resistors R14, R15, and R16 form a current divider network, which maintains a constant input impedance for the horizontal position voltage inputs to Q4. This holds the gain of Q4 constant regardless of the setting of R18.

2.7.2 Sawtooth Shaping Network. - This network modifies the shape of the sawtooth output of the sweep generator before it is applied to the voltage tuning elements in A3. This is done to compensate for the non-linearity in the change in capacity of the varactors with a linear sawtooth applied. If an unmodified sawtooth were applied to the 160 MHz tuner (A3), signals which are equidistant from the 160 MHz center frequency would appear at different distances from the center of the CRT screen. Thus, by shaping the tuning voltage waveform, the frequency sweep is made linear.

2.7.2.1 The sweep voltage polarity from sweep generator A8 is selected by sweep switch S3 and coupled through R8 to the front panel SWEEP WIDTH control (see Figure 6-11). From the arm of the SWEEP WIDTH control, the sawtooth is applied to module pin 7 of the horizontal amplifier board. The SWEEP WIDTH control determines the maximum amplitude of the sawtooth applied to the shaping circuit and thus the maximum frequency sweep. With the sawtooth input at its maximum negative excursion, the reverse bias applied to the varactor diodes is at maximum, resulting in the high end of the frequency sweep. At this point, diodes CR1 and VR2 are biased to conduction, placing R23 in parallel with R22. This parallel combination forms a voltage divider with R24 which governs the output at module pin 6 for a given negative sweep input. As the sawtooth swings positive, a point is reached where CR1 and VR2 stop conducting. When this occurs, R23 is effectively removed from the circuit and the output voltage decreases for a given input. This is the first break point in the slope of the shaped sawtooth output. The sawtooth is not further modified until it has crossed the zero volt axis and becomes sufficiently positive to

cause CR2 to conduct. Conduction through CR2 places R25 and R26 in parallel with R24 providing the second break point in the slope of the shaped output. The third "break point" occurs when the sawtooth voltage is sufficiently positive to cause VR3 to conduct placing R27 and R28 in parallel with R24, R25, and R26. The "break point" potentiometers are provided to adjust the slope of the sawtooth at the two positive points to maximize the linearity of the sweep on the low frequency end of the sweep dispersion range.

2.7.3 Marker Amplitude Adjust. - Potentiometer R29 and R30 form a voltage divider from the +18V supply. The output voltage from module pin 9 is applied to the 160 MHz marker oscillator (A3A1) to set the desired amplitude of the center frequency marker.

2.7.4 CRT Anode Voltage Divider. - Resistors R31 and R32 form a voltage divider from the +200V supply to provide +100V on the CRT anode.

2.7.5 Sweep Rate Voltage Divider. - Resistors R20 and R21 in conjunction with the main chassis SWEEP RATE control form a voltage divider from the +24V supply. The output voltage from module pin 13 is applied to the current generator which supplies charging current to the capacitor for the sweep oscillator in module A8.

2.7.6 Sweep Oscillator Reference. - Zener diode VR1 provides +8.2V output through module pin 5. This voltage is applied to main chassis CENTER FREQUENCY potentiometer R3 and R7. The voltage from the arm of R3 sets the initial bias on the varactor tuning elements in 160 MHz tuner A3.

2.8 PART 13488 FOCUS AND INTENSITY BOARD

Figure 6-6 is the schematic diagram; the reference designation prefix is A5. This module is a voltage divider circuit which supplies various element voltages for the cathode ray tube. The divider operates between -1500 volts applied at E1 from supply module PS-1 and ground. Voltage for the focus grid is adjusted by R4 and the voltage between the CRT cathode and control grid (INTENSITY) is adjustable by R2. The total resistance of the divider is 15 megohms, and the drop is thus 100V per megohm. Thus the voltage between cathode and control grid can be varied between 10 and 60V, and the focus grid voltage between 390 and 140V. Capacitor C1 is a ripple filter which prevents intensity modulation of the CRT trace by ac hum.

2.9 TYPE 8026 IF AMPLIFIER

Figure 6-7 is the schematic diagram for this module; its reference designation prefix is A6. The circuit consists of three cascaded amplifier stages tuned to 21.4 MHz. The stages are functionally identical except for the first stage which contains a gain adjustment circuit. Dual insulated gate field-effect transistors are used for all three stages. The overall purpose of this module is to provide selectivity for the 21.4 MHz input and output signals rather than voltage gain. The overall bandwidth of the amplifier is 300 kHz, nominal.

2.9.1 A capacitive divider impedance matching network is provided by C1 and C2 which resonate at 21.4 MHz with L1. Bias on gate 2 (pin 2) of Q1 is set by R5 in conjunction with R2, R3, and R4. Source bias on the stage is clamped by diode CR1 from the -18V supply through R13 and R8. A small amount of source degeneration is provided by R7 to stabilize the stage. From the drain of Q1, the output from the stage is coupled through parasitic suppressor R6 to a tuned circuit composed of L2, C7, and C8 which resonates the stage and provides impedance matching to Q2. The remaining two stages are identical to Q1 with the exception of the gain adjust circuit.

2.10 TYPE 8138 OUTPUT AMPLIFIER

Figure 6-8 is the schematic diagram for the output amplifier; its reference designation prefix is A7. This module is driven by IF amplifier A6.

2.10.1 Cascode Amplifier. - Transistors Q1 and Q2 form a 21.4 MHz cascode amplifier. Input signals to the amplifier are applied through a double-tuned bandpass network consisting of L1, C3, and L2. Input to the base of Q2 is taken from a capacitive divider (C4 and C5) and coupled through C6. Transistors Q1 and Q2 are biased from the +24 and -18 volt supply inputs by R2, R3, R4, and R7. Capacitor C7 holds the base of Q1 at RF ground. Inductor L3, C11, and C12 tune the stage to 21.4 MHz. The cascode amplifier drives detector circuits which supply vertical drive to the CRT deflection plates and a vertical output.

2.10.2 Vertical Output Detector. - The vertical output detector consists of diodes CR2 and CR6 and associated components and is driven from the junction of C11 and C12. A half wave voltage doubler detector circuit is used for the vertical output. On the negative half cycles of the output of Q1, C11 and C12 charge to approximately the peak of the voltage applied to the detector. On the positive half cycles CR6 conducts supplying a dc voltage that is approximately the peak-to-peak value of the applied RF signal to R12 and C19. Resistor R12 and C19 form a pulse stretching circuit to increase the response of the vertical display for pulse type signals. The vertical output is coupled through R17 to module pin 7. Capacitor C22 supplies additional filtering for the vertical output.

2.10.3 CRT Vertical Detectors. - The detector circuit which drives the vertical deflection plates of the CRT consists of diodes CR1, CR5, CR3, CR4, and associated components. Voltage doubler circuits are used to obtain the required voltage swing at the CRT deflection plates. Output voltages of equal amplitude but opposite polarity are produced at module pins 5 (positive) and 6 (negative). In addition a dc vertical position voltage is obtained from the +200 volt supply and the vertical position is adjustable with R13. Considering the positive output circuit, on the negative half-cycles of the input signal CR3 is forward biased and C13 charges to the peak value of the applied signal less the drop across CR3. The current flow through the capacitor results in the end connected to the diodes being positive with respect to the other end. On the positive half-cycles CR4 is forward biased so that current flows charging C17. Since C13 is already charged to almost the peak applied voltage and is in series with the input voltage, its potential is added to the peak value of the applied voltage. Thus, C17 is charged to the peak of the applied voltage plus the charge across C17. As a result, the voltage across C17 is approximately equal to the peak-to-peak value of the applied voltage. Capacitors C15, C20, and resistor R14 supply filtering of the positive vertical output voltage. The negative voltage detector circuit is functionally identical to the positive detector.

2.11 TYPE 8243 SWEEP GENERATOR

Figure 6-9 is the sweep generator schematic diagram; the reference designation prefix is A8. This board generates the basic sawtooth waveform, and supplies horizontal sweep, positive sweep voltage, negative sweep voltage and external sweep outputs. In addition, the vertical output amplifier is located on the board.

2.11.1 Sawtooth Generator. - Unijunction transistor Q1, capacitor C5, and current source Q2 form the sawtooth oscillator. Transistor Q2 supplies the charging current for C5 and supplies a constant charging current to the capacitor determined by the rate voltage input from the main chassis SWEEP RATE control. This current charges C5 at a linear rate until the PN junction of Q1 becomes forward biased. When this occurs, the capacitor is rapidly discharged through the unijunction transistor until the charge across C5 is insufficient to hold Q1 in conduction. Then the capacitor begins charging again through Q2 and the cycle repeats.

2.11.2 Unity Gain Amplifier, U1. - Operational amplifier U1 functions as a buffer between the sawtooth oscillator and the remainder of the sweep circuitry. The sawtooth input from C5 is applied to the non-inverting input (pin 3). Negative feedback from pin 6 to pin 2 is employed. The output coupled through R9 to module pin 20 swings from +3 to +13 volts. A portion of the output of U1 is applied to the inverting input of U2.

2.11.3 Inverter/Level Shifter, U2. - Operational amplifier U2 receives the sawtooth input at the inverting input (pin 2). A dc offset voltage is applied to the noninverting input (pin 3) from potentiometer R5. Potentiometer R5 is a portion of a voltage divider from the +18 volt supply consisting of R4, R5, and R6. Negative feedback from pin 6 through R11 and R10 is used to set the stage gain. Potentiometers R5 and R11 are adjusted to supply a 10 volt peak-to-peak negative sawtooth centered about zero volts from module pin 4. The sawtooth output of U2 also drives U3 and U4.

2.11.4 Unity Gain Inverter, U3. - This operational amplifier supplies the positive sweep voltage output at module pin 10. Negative feedback is supplied through R15. The ratio of resistor R15 and input resistor R13 sets the stage gain at one.

2.11.5 External Sweep Output Amplifier, U4. - Operational amplifier U4 is also driven by U2. It supplies the external sweep output at rear panel jack J3 through module pin 18. It is an inverting amplifier and its gain is adjustable from unity to approximately X2. Potentiometer R14 is adjusted to provide a 20 volt peak-to-peak output at J3.

2.11.6 Vertical Output Amplifier, U5. - This operational amplifier supplies vertical output signals at rear panel jack J2 through module pin 5. Its input is supplied by the vertical output detector circuit in output amplifier

A7. Input signals are applied through module pin 6. The vertical signal is taken from the junction of R19 and R20 and applied to the non-inverting input of U5. A vertical gain adjustment circuit is provided by a negative feedback voltage divider consisting of R17, R18, and R21. Potentiometer R18 is adjusted to provide 1 volt peak output at jack J2 with a 10 μV input signal applied to the SM-1622.

2.12 TYPE 79750 BANDPASS FILTER

Figure 6-10 is the schematic diagram for this module; its reference designation prefix is A9. The filter has a 21.4 MHz center frequency and a bandwidth of 200 kHz. Components of the filter, with the exception of the input and output connectors, are constructed on a printed circuit board mounted within the filter assembly.

2.12.1 Part 16029 Filter PC Board. - The reference designation of this board is A9A1. The circuit is a two section bandpass filter tunable by C2 and C4. Coupling between the two sections is through C6.

2.13 TYPES SM-1621 AND SM-1622

Figure 6-11 is the main chassis schematic diagram for the SM-1621 and SM-1622 Signal Monitors. Main Chassis wiring between the subassemblies, power transformer primary and secondary wiring, CRT wiring, and wiring to DC-DC converter PS1 is illustrated. Front panel controls and indicator and rear panel controls and jacks are shown in this diagram.

2.13.1 PS1 DC-DC Converter. - This module receives +24 Vdc from A2 and provides +200 and -1500 volt outputs. It is constructed as a sealed module and is a non-repairable item.

SECTION III

INSTALLATION AND OPERATION

3.1 UNPACKING AND INSPECTION

3.1.1 Examine the shipping carton for damage before the equipment is unpacked. If the carton has been damaged, try to have the carrier's agent present when the equipment is unpacked. If not, retain the shipping cartons and padding material for the carrier's inspection if damage to the equipment is evident after it has been unpacked.

3.1.2 See that the equipment is complete as listed on the packing slip. Contact Watkins-Johnson Company, CEI Division, or your Watkins-Johnson representative with details of any shortage.

3.1.3 The unit was thoroughly inspected and factory adjusted for optimum performance prior to shipment. It is, therefore, ready for use upon receipt. After uncrating and checking contents against the packing slip, visually inspect all exterior surfaces for dents and scratches. Remove the dust covers and inspect the internal components for apparent damage. Check the internal cables for loose connections and plug-in items, such as printed wiring boards, which may have been loosened from their receptacles.

3.2 INSTALLATION

The Type SM-1622 Signal Monitor is designed for half-rack mounting. It can be mounted in a Type EF-101 or EF-201C Equipment Frame. The EF-101 mounts a single half-rack unit and the EF-201C can mount two half-rack units. Both equipment frames required 3.5 inches of vertical rack space and install in a standard 19-inch rack. If used in a mobile installation, some means should be devised to support the sides and/or rear of the equipment. A brace extending along the sides from the front panel to the rear apron is preferred. Do not rely solely on the front-panel mounting hardware to support the unit. The rack installation should allow a free flow of air through the holes in the top and bottom dust covers of the equipment frame used. For this reason, at least 1/8-inch of clearance above and below the equipment frame should be provided. The installation should also allow access to the rear panel so that input and output connections can be made and changed if desired. The rear panel connections to the signal monitor are described in the following paragraphs. A rear view of the unit is shown in Figure 5-2.

3.2.1 Power Connection. - Turn the POWER switch off. Plug the power cord into a 115 or 230 Vac, 50-400 Hz, source. The third pin of the power plug grounds the unit. If a three-pin receptacle is not available use the three-to-two pin adapter provided. Be sure to attach the wire from the adapter to a suitable ground. Before energizing the SM-1622, check the rear-panel input voltage selector switch, S4, to make sure it is in the proper position for the line voltage being used.

3.2.2 Input. - Connect the 160 MHz IF input to rear panel jack, J1. This jack is a BNC connector.

3.2.3 Vertical Output. - Rear-panel jack, J2, supplies the SM-1622 vertical output to an auxillary video display device, such as an oscilloscope. This output will supply 1 volt peak, nominal, into a 100K ohm load.

3.2.4 Horizontal Output. - The SM-1622 horizontal sweep voltage is available at rear-panel jack J3. This output will deliver 20 volts peak-to-peak, nominal, into a 100K ohm load.

3.3 OPERATION

The operation of the various controls on the SM-1622 is described in the following paragraphs. Front and rear views of the signal monitor are shown in Figures 5-1 and 5-2.

3.3.1 Power Switch. - The POWER toggle switch controls the ac input to the SM-1622. Make certain that the setting of the rear-panel voltage selector switch marked 115/230V is set to match the power source before the signal monitor is energized. A front-panel lamp indicates power on. Allow several minutes warm-up before using the signal monitor.

3.3.2 Gain. - The GAIN control varies the height of the pips displayed on the CRT. Adjust this control as necessary to maintain the desired height of the display.

3.3.3 Marker. - When used, the MARKER switch results in a pip on the CRT. This pip indicates the 160-MHz center of the signal monitor response.

3.3.4 Focus. - The FOCUS control provides a means for obtaining a sharp trace on the face of the CRT.

3.3.5 Intensity. - The INTENSITY control varies the brightness of the trace on the CRT.

3.3.6 Sweep Width. - The SWEEP WIDTH control varies the width of the frequency spectrum being viewed. When this control is in the maximum clockwise position, the maximum bandwidth (20 MHz) is being displayed.

3.3.7 Sweep Rate. - The SWEEP RATE control is used to obtain optimum resolution at the sweep width being used and to prevent the loss of sensitivity by sweeping too fast.

3.3.8 Center Frequency. - The CENTER FREQ control varies the horizontal position of the pips on the CRT. Under normal operation, use this control to center the frequency spectrum under display on the center mark of the CRT screen.

3.3.9 Sweep Direction Switch. - The rear-panel sweep direction switch, S3, reverses the spectrum display on the CRT. Observing the signal monitor display, tune the associated receiver higher in frequency. Intercepted signals should first appear at the right-hand end of the trace and move to the left. If signals appear at the left-hand of the trace and move to the right, change the position of the sweep direction switch.

3.4 INTERPRETATION OF SIGNALS

The following list is presented as a guide for interpretation of various signals and waveforms that might appear on the CRT.

(1) An unmodulated carrier without noise or random disturbances will appear as a deflection with fixed height.

(2) A carrier that is amplitude modulated will appear as a deflection of variable height. If the modulation rate is high, sidebands may appear.

(3) A single-tone-modulated FM signal will appear as a group of spikes corresponding to the center frequency and the sidebands.

(4) Noise appears as varying irregularities or "grass" along the base line and may be eliminated by a reduction of the GAIN control setting.

3.5 PREPARATION FOR RESHIPMENT AND STORAGE

3.5.1 If the unit must be prepared for reshipment, the packaging methods should follow the pattern established in the original shipment. If retained, the original materials can be reused to a large extent or will at a minimum provide excellent guidance for the repackaging effort.

3.5.2 If time permits, contract packing and packaging firms can be found in many cities. Based on an examination of the equipment and the proposed method of shipment, these firms can usually perform a reliable repackaging service.

3.5.3 As a minimum, cover the painted surfaces of the unit with wrapping paper. Pack the unit securely in a strong corrugated container (350 lb/sq inch bursting test) with 2-inch rubberized hair pads placed along all surfaces of the equipment. If rubberized hair is not available, use a 6-inch layer of excelsior. If neither of these filler materials are available, use crumpled paper, rags, or any other available materials to provide as much cushioning as possible.

3.5.4 Conditions during storage and shipment should normally be limited as follows:

(a) Maximum humidity: 95% (no condensation)
(b) Temperature range: -30°C to +85°C.

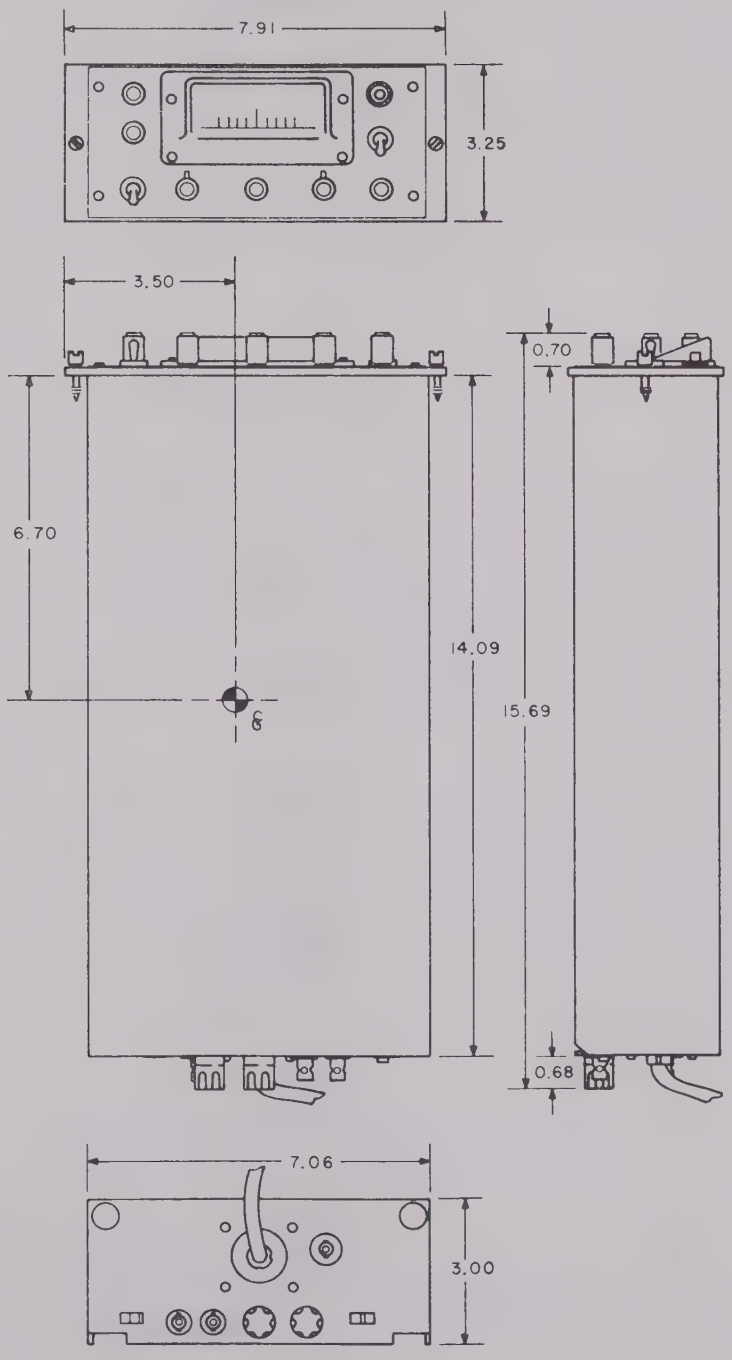


Figure 3-1. Type SM-1622 Signal Monitor, Critical Dimensions

SECTION IV

MAINTENANCE

4.1 GENERAL

The Type SM-1622 Signal Monitor has been conservatively designed to operate for extended periods of time with little or no routine maintenance. An occasional cleaning and inspection are the only preventive maintenance operations recommended. The intervals for these operations should be based on the operating environment. Should trouble occur, repair time will be minimized if the maintenance technician is familiar with the circuit descriptions found in Section II. Reference should also be made to the block diagram, Figure 2-1, and to the schematic diagrams found in Section VI. A complete parts list and illustrations showing part locations can be found in Section V.

4.2 CLEANING AND LUBRICATION

The unit should be kept free of dust, moisture, grease, and foreign matter to ensure trouble-free operation. If available, use low velocity compressed air to blow accumulated dust from the exterior and interior of the unit. A clean dry cloth, a soft bristled brush, or a cloth saturated with cleaning compound may also be used. The Type SM-1622 Signal Monitor does not require lubrication.

4.3 INSPECTION FOR DAMAGE OR WEAR

Many potential or existing troubles can be detected by a visual inspection of the unit. For this reason, a complete visual inspection should be made for indications of mechanical and electrical defects on a periodic basis, or whenever the unit is inoperative. Electronic components that show signs of deterioration should be checked and a thorough investigation of the associated circuitry should be made to verify proper operation. Damage to parts due to heat is often the result of other less apparent troubles in the circuit. It is essential that the cause of overheating be determined and corrected before replacing the damaged parts. Mechanical parts, and front panel controls and switches should be inspected for excessive wear, looseness, misalignment, corrosion, and other signs of deterioration.

4.4 ALIGNMENT AND ADJUSTMENT PROCEDURES

4.4.1 General. - The alignment procedures given here are suitable when making adjustments after replacing transistors or components. Only those controls specifically referred to within a series of steps given for aligning a particular circuit affect the alignment of that circuit. Those controls not mentioned in any one series of steps may be left in any position. The alignment of the signal monitor should be performed only with suitable equipment by technicians thoroughly familiar with the unit. If the limits and tolerances specified in the following procedures cannot be obtained, then a factory alignment is necessary.

4.4.2 Test Equipment Required. - The following test instruments, or their equivalents, are required to align the SM-1622.

(1) VTVM, RCA WV-98C.
(2) Signal Generator, Hewlett Packard, Type 608E.
(3) Frequency Counter, Computer Measurements Co., Type CMC-738A with a Type CMC-735C plug in frequency converter.
(4) Oscilloscope, Tektronix Type 503.
(5) Tuning Tool, JFD 5284
(6) Tuning Tool, Cambion 2033
(7) Tuning Tool, Indiana General insulated slot driver.
(8) Assorted cables, connectors and adapters.

4.4.3 Control Settings. - Before starting the alignment, place the SM-1622 controls in the positions indicated.

(1) POWER - ON
(2) FOCUS - MAX CW

(3) INTENSITY - MAX CW
(4) SWEEP RATE - MAX CW
(5) SWEEP WIDTH - MAX CW
(6) MARKER - OFF
(7) SWEEP, S3, - POS. 2
(8) CENTER FREQ - CENTER RANGE REFERENCE
(9) GAIN - MAX CCW

4.4.4 Power Supplies. - Check and adjust the power supplies as follows:

(1) Using the VTVM, check the voltage on pin 18 of XA1 for -18 Vdc, ± 10%.

(2) Measure the voltage on pin 13 of XA2 and adjust A2R7 for +24 Vdc, ± 10%.

(3) Check for +18 Vdc, ±10% on pin 18 of XA2.

WARNING

High voltages for operation of the CRT are present at many points in the SM-1622. Exercise caution when working with the unit. Special care should always be taken to discharge PS1 prior to working on the SM-1622. Do not rely on bleeder circuits. An open circuit may have occurred which leaves lethal charges present.

(4) Check for -1500 Vdc, ±20% on pin 4 of PS1. Check pin 2 of PS1 for +200 Vdc, ±20%.

4.4.5 Coarse Sweep Alignment. - The following adjustments will provide coarse alignment of the SM-1622 sweep circuits. Proper adjustment will provide a trace on the CRT screen which will allow more precise alignment in following paragraphs.

4.4.5.1 Sweep Generator. - Proceed as follows:

(1) Leave the SM-1622 controls in the positions indicated in paragraph 4.4.3 until directed to make a change.

(2) Connect the oscilloscope vertical input to pin 20 of XA8. Adjust the oscilloscope controls to display the sawtooth waveform. The sawtooth should start at +3 volts and rise to +13 volts. This response indicates proper operation of the sawtooth generator.

(3) Connect the oscilloscope vertical input to pin 4 of XA8. Observe the oscilloscope and adjust A8R5 (BIAS) to center the waveform about zero volts. Adjust A8R11 (SWEEP CAL) for maximum amplitude of the sawtooth waveform without clipping and then re-center the sawtooth with A8R5 (BIAS).

(4) Adjust A7R13 (vertical position) to place the CRT trace near the bottom of the screen. Adjust the FOCUS and INTENSITY controls as desired. Re-adjust A7R13 as necessary.

4.4.5.2 Horizontal Amplifier. - Proceed as follows:

(1) Adjust A4R3 for minimum horizontal deflection on the CRT screen.

(2) Center the horizontal trace with A4R18 (HORIZ POS).

(3) Adjust A4R3 (HORIZ WIDTH) for a trace width approximately 10% greater than full width.

Figure 4-1

NOTE

Insufficient trace width will cause the CRT retrace to be visible at the left side of the CRT screen during later adjustments.

4.4.6 RF and Sweep Alignment. - These adjustments will provide proper linearity of the sweep circuitry and 20 MHz RF bandwidth for the SM-1622.

4.4.6.1 21.4 MHz Circuits. - Proceed as follows:

(1) Set the SWEEP WIDTH control to maximum CCW.

(2) Connect the test equipment as shown in Figure 4-1.

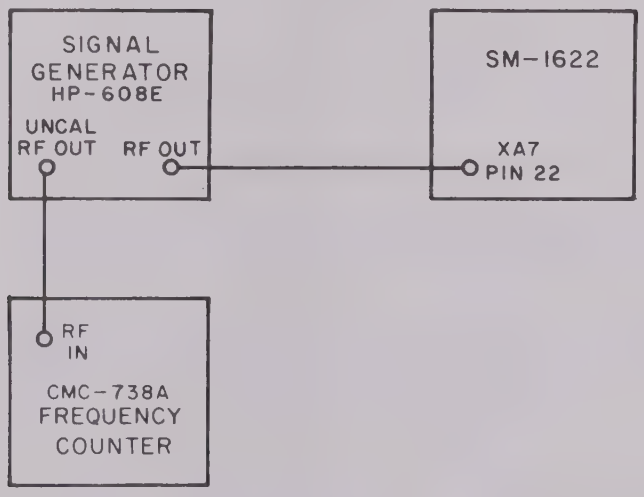


Figure 4-1. Equipment Connections, 21.4 MHz RF Alignment

(3) Adjust the signal generator for a 21.4 MHz CW output signal at sufficient amplitude to obtain a vertical deflection on the SM-1622 CRT.

(4) Using the non-metalic slot driver, adjust A7L3 for maximum vertical CRT trace deflection. Reduce the signal generator output level to keep the CRT trace on screen.

(5) Repeat step (4) adjusting A7L2, then A7L1.

(6) Connect the signal generator to pin 21 of XA6. Repeat step (4) adjusting A6L4, A6L3, A6L2, and A6L1 in the order given.

(7) Move the signal generator output cable to A9J1. Adjust the signal generator output level to obtain a half screen vertical CRT trace deflection.

(8) Adjust A9A1C4 and A9A1C2 for maximum vertical CRT trace deflection in the order given reducing the signal generator output as necessary to keep the trace on screen. Restore the original cable connection to A9.

4.4.6.2 160 MHz RF and Sweep Circuits. - Proceed as follows:

(1) Set the SWEEP WIDTH control maximum CW; GAIN maximum CW.

(2) Connect the equipment as shown in Figure 4-2.

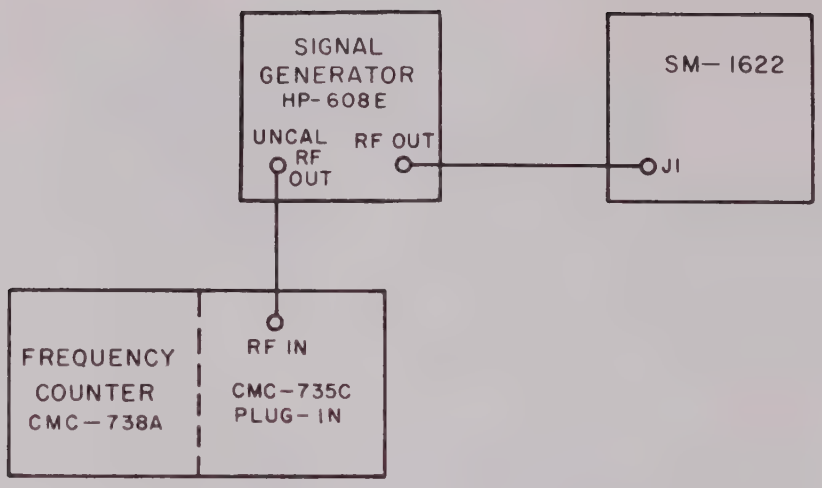


Figure 4-2. Equipment Connections, 160 MHz, RF and Sweep Circuit Alignment

(3) Adjust A3C2 for minimum capacity (maximum CCW). Set A3R33 to the maximum CW position.

(4) Adjust the signal generator for a 160 MHz CW signal and set the output level for a 160 MHz signal on the CRT screen. Note the trace position of the 160 MHz pip and set the signal generator output level to minimum.

(5) Set the GAIN control to maximum CCW and then set A4R29 (MARKER) maximum CCW. Turn the MARKER switch ON. Adjust A3A1C3 until the 160 MHz marker appears and then for maximum amplitude. Set A4R29 (MARKER) for a convenient marker level.

(6) Center the marker on the CRT screen with A3C36 and adjust A3C25 for maximum marker deflection.

(7) Vary the SWEEP WIDTH control while observing the marker signal. Slowly adjust A3C36 until the marker pip does not move horizontally as the SWEEP WIDTH control is changed from maximum CCW to maximum CW. This adjustment is facilitated by observing the top of the marker pip.

(8) Adjust A4R18 (HORIZ POS) to center the marker on the CRT screen if necessary. Repeat step (7) to insure that the marker does not move horizontally as the SWEEP WIDTH control is varied.

(9) Set the SWEEP WIDTH control as desired. Use the Cambion 2033 tuning tool, adjust A3T4 for maximum marker amplitude. Turn the marker OFF.

(10) Set the GAIN control to 3/4 of maximum CW. Adjust the signal generator output level for a half-screen deflection 160 MHz pip. Adjust A3C13 and A3C23 for maximum signal deflection reducing the signal generator as necessary to maintain a half-screen deflection.

4.4.7 20 MHz Bandwidth Adjustment. - Proceed as follows:

(1) Connect the equipment as shown in Figure 4-2. Adjust the signal generator controls for a 10 μV 160 MHz CW output.

(2) Set the SWEEP WIDTH maximum CW and the GAIN control for nearly full screen vertical deflection of the 160 MHz pip.

(3) Tune the signal generator from 150 to 170 MHz and note the point of maximum vertical pip deflection. At the point of maximum deflection set the GAIN control for a full screen pip.

(4) Tune the signal generator over the 150 - 170 MHz range while observing the CRT screen and note the point of minimum vertical pip deflection. At that frequency, increase the signal generator output to 14.1 μV (3 dB). The resulting vertical pip deflection should be at least full screen. If not, adjust A3C13 and A3C23 for a compromise over the 150-170 MHz range which will provide the 20 MHz bandwidth at the -3 dB points.

(5) If the preceding adjustments do not obtain the required 3 dB banwidth, A3C25 can be peaked at the frequency of minimum deflection as noted in step (4). If this adjustment is required, return the signal generator to 160 MHz and re-center the pip on the CRT screen with A3C36 and then repeat step (4).

4.4.8 Image Trap Adjustment. - Proceed as follows:

(1) Turn the MARKER switch on. Connect the equipment as shown in Figure 4-2. Set the signal generator output level to 1mV and tune the generator to approximately 201.4 MHz. Tune the signal to center the signal pip over the 160 MHz marker and turn the MARKER switch off.

(2) Set the signal generator output level for a half-screen pip deflection and adjust A3C2 for minimum deflection. Adjust the GAIN control as necessary to obtain the maximum image null.

4.4.9 Width and Linearity Adjustments. - Proceed as follows:

(1) Connect the equipment as shown in Figure 4-2. Turn the MARKER switch ON.

(2) Tune the signal generator to 170 MHz with a 10 μV CW output signal. Adjust the GAIN control for a convenient 170 MHz pip deflection.

(3) Adjust A8R11 (SWEEP CAL) to move the 170 MHz pip to the right most graticule line on the CRT screen. Re-center the 160 MHz marker with A8R5 (BIAS). Repeat until the 170 MHz pip and 160 MHz marker are in the proper positions.

(4) Tune the signal generator to 155 MHz and adjust A4R26 (HORIZ NOM LIN) to place the signal pip halfway between the center and left-most graticule lines.

(5) Tune the signal generator to 150 MHz and adjust A4R28 (HORIZ MAX LIN) to position the 150 MHz pip on the left-most CRT graticule line.

(6) Repeat steps (2) through (5) until the width and linearity adjustments are correctly set. Turn the signal generator output level to minimum. Turn the MARKER switch off.

4.4.10 Vertical Position. - Proceed as follows:

(1) With the FOCUS, INTENSITY, and GAIN controls set as desired, adjust A7R13 (vertical position) to position the CRT trace on the base line of the CRT graticule.

(2) The vertical position varies slightly with changes in intensity and focus. Adjust A7R13 as desired for normal SM-1622 operation.

4.4.11 Vertical and Horizontal Output Level Adjustments. - Proceed as follows:

(1) Connect the equipment as shown in Figure 4-3.

(2) Adjust the signal generator for a 160 MHz CW output at a level of 10 μV.

(3) Adjust the GAIN control for a full screen 160 MHz pip deflection.

(4) Adjust A8R18 (EXT VERT) for a 1.0 volt peak vertical output as displayed on the oscilloscope.

(5) Adjust A8R14 (EXT HORIZ) for a 10 cm horizontal deflection of the oscilloscope trace with the oscilloscope external horizontal controls in the 2 V/CM position.

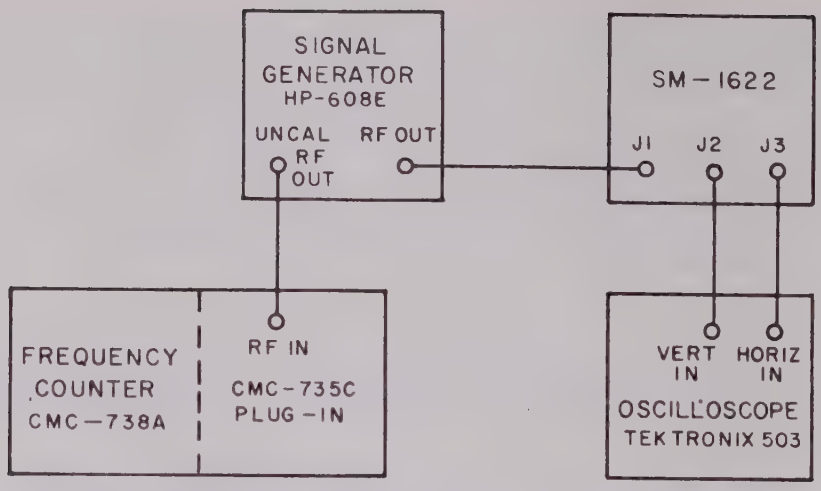


Figure 4-3. Equipment Connections, Vertical and Horizontal Output Adjustments

4.4.12 Marker Amplitude. - Proceed as follows:

(1) With no external input to the SM-1622, place the MARKER switch on.

(2) Adjust A4R29 (MARKER) for a 75% of full screen marker pip deflection.

4.5 TROUBLESHOOTING

Troubleshooting efforts should first be directed toward localizing the problem to a particular module or circuit group. As aids in this process, this manual contains troubleshooting information in tabular form (Table 4-1), a functional block diagram (Figure 2-1), and a complete circuit description (Section II). Once the faulty module has been located, the defective component should be isolated using data obtained from the circuit descriptions, voltage measurements (Table 4-2) and schematic diagrams (Figures 6-1 through 6-11).

4.5.1 Localizing Troubles. - Isolation of faults in the SM-1622 can be accomplished by waveform tracing through the sweep circuits with an oscilloscope, voltage measurements with a high impedance voltmeter through the power supply circuits, and injecting the appropriate signals at the inputs of the various RF modules. The most probable cause of faults will be failure of field effect transistors in the 160 MHz tuner subassembly. These transistors can be easily checked by carefully measuring the element voltages and comparing the readings obtained with the correct voltages listed in Table 4-2. Table 4-1 lists major trouble symptoms and procedures to help isolate the faulty module.

Table 4-1. Troubleshooting

Trouble Symptom	Probable Cause	Procedure
Unit totally inoperative	Power supply failure	Check: input power source, line fuses F1 (115 Vac) F2 (230 Vac), power transformer T1, regulator boards A1 and A2, and PS1.
Power supply voltages normal, no CRT trace	Sweep circuit failure, focus and intensity board failure, or CRT failure	Check: sweep generator A8, horizontal amplifier A4, focus and intensity board A5, and vertical trace positioning circuit on output amplifier A7
CRT trace normal, no signal (vertical deflection)	Failure of 160 MHz Tuner A3, bandpass filter A9, IF amplifier A6, or output amplifier A7	Supply an input signal at the proper fre- to each module beginning with output amplifier A7 and check for vertical deflection on the CRT. Continue tracing in this manner until the faulty RF module is located.

4.6 PERFORMANCE CHECKS

Selected performance tests are presented in subsequent paragraphs which can be used to determine the relative performance of the Type SM-1622 Signal Monitor.

4.6.1 Power Supply Tests. - The following tests will ensure that the power supplies are performing within acceptable limits.

4.6.1.1 The following test equipment is required:

1. Variac, General Radio, Type W5MT3A.
2. VTVM, RCA, Type WV-98C.

4.6.1.2 Connect the SM-1622 power input to the variac. Use the voltmeter to check the voltages as outlined:

1. With the line voltage maintained at 115 Vac:

Power Supply	Measured at	Minimum Reading	Maximum Reading
-18V	XA1 pin 18	-16.2	-19.8
+18V	XA2 pin 18	+16.2	+19.8
+24V	XA2 pin 14	+22.6	+26.4
+200V	PS1 pin 2	+180	+220
-1400	PS1 pin 4	-1200	-1600

2. Maintain the line voltage at 125 Vac and repeat the measurements listed in step 1. above.
3. Maintain the line voltage at 105 Vac and repeat the measurements listed in step 1. above.

4.6.2 Sensitivity, Linearity, Flatness of Response, Center Frequency, and 160 MHz Marker Test. - The following tests will ensure proper sensitivity, linearity, flatness of response, center frequency and marker accuracy of the SM-1622.

4.6.2.2 The following test equipment is required:

1. Signal Generator, Hewlett Packard, Type 608E.
2. Frequency Counter, Computer Measurements Co., Type 738A with a Type 735C plug-in.

4.6.2.3 Proceed as follows:

1. Connect the signal generator output to the SM-1622 RF input jack, J1.
2. Connect the signal generator UNCAL RF OUT to the frequency counter RF input.
3. Make the following SM-1622 control adjustments:

   POWER - ON
   FOCUS and INTENSITY - AS DESIRED
   SWEEP WIDTH - MAX CW
   SWEEP RATE - MAX CW
   SWEEP, S3, - POS. 2
   CENTER FREQ - CENTER RANGE REFERENCE
   GAIN - MAX CW
   MARKER - ON

4. Adjust the signal generator controls for a 10 μV 155 MHz CW output. Reduce the signal monitor GAIN until the 155 MHz signal is the same height as the 160 MHz marker.
5. Slowly tune the signal generator toward 160 MHz while reducing the SM-1622 SWEEP WIDTH until a zero beat is obtained with the 160 MHz marker. At zero beat, the frequency counter readout should be between 159.984 and 160.016 MHz. This verifies correct performance of the 160 MHz marker. The vertical pip should be centered on the CRT screen. This verifies correct alignment of the sweep oscillator.

6. Turn the MARKER off. Set the SWEEP WIDTH to maximum CW and adjust the signal monitor GAIN control to MAX CW. The 160 MHz signal response should be at least one inch high. This verifies proper sensitivity for the SM-1622.

7. Adjust the GAIN control for a vertical deflection slightly less than full screen. Tune the signal generator from 150 to 170 MHz and note the points of minimum and maximum pip amplitude. At the frequency of maximum pip amplitude adjust the GAIN control for a full screen deflection. Tune the signal generator to the frequency of minimum pip amplitude in the 150 - 170 MHz range. Increase the signal generator output to obtain a full screen deflection. The generator output should be no more than 14.1 μV (3 dB increase). This verifies a maximum of 3 dB ripple in the SM-1622 bandpass.

8. Return the signal generator output level to 10 μV and tune it to 150 MHz. The pip should be centered over the left-most graticule line on the CRT screen ± 1/2 division. Tune the signal generator to 155 MHz. The pip should be centered between the center and left-most graticule lines ± 1/2 division. Tune the signal generator to 165 MHz. The pip should be centered between the center and right-most graticule lines ± 1/2 division. Tune the signal generator to 170 MHz. The pip should be centered over the right-most graticule line ± 1/2 division. This verifies adequate sweep linearity for the SM-1622.

9. Place rear panel sweep switch, S3, to POS. 1. The vertical pip should move to the left-most graticule line on the CRT face. This verifies proper operation of the sweep direction reversing circuits.

4.6.3 Vertical and Horizontal Outputs. - This test will ensure proper output levels from the SM-1622 rear panel vertical and horizontal outputs.

4.6.3.1 The following test equipment is required:

1. Signal Generator, Hewlett Packard, Type 608E.
2. Oscilloscope, Tektronix, Type 503.

4.6.3.2 Proceed as follows:

1. Connect the signal generator, oscilloscope and SM-1622 as shown in Figure 4-3.
2. Place the SM-1622 controls in the positions specified in paragraph 4.6.2.3 step 3.
3. Adjust the signal generator controls for a 10 μV 160 MHz CW output. Set the oscilloscope vertical controls for 0.2V/CM and external horizontal controls for 2V/CM.
4. Adjust the SM-1622 GAIN control for a full screen 160 MHz pip. The oscilloscope display should be a 10 CM horizontal deflection with a 5 CM vertical pip centered horizontally on the tube face.

NOTE

Adequate performance is indicated with the vertical, horizontal, and centering parameters within 5% of that indicated in step (4) above.

Table 4-2. Transistor and Integrated Circuit Element Voltages

Ref Desig	Type	Integrated Circuit Pin Numbers									
		1	2	3	4	5	6	7	8	9	10
		Field Effect Transistor Pins							Transistor Elements		
		Drain	Gate 2	Gate 1	Source				Emitter	Base	Collector
A1Q1	2N4037								-18.2	-18.8	-32.0
A1Q2	2N4037								-18.8	-19.6	-40.0
A2Q1	2N3055								24.0	23.5	35.5
A2Q2	2N2270								23.5	24.6	35.5
A2Q3	2N2270								6.7	7.2	24.6
A2Q4	2N2270								6.7	7.3	23.0
A2Q5	2N2270								18.5	19.2	24.0
A3Q1	3N140	18.5	3.55	1.2	1.5						
A3Q2	3N140	18.5	3.55	1.2	1.6						
A3Q3	2N2857								7.8	8.6	18.0
A3Q4	2N3933								3.0	3.7	18.5
A3Q5	2N2857								8.0	8.8	18.0
A3A1Q1	2N3933						See Note (1)		3.9	4.5	9.0
A4Q1	2N2270								6.8	7.3	23.2
A4Q2	2N2270								6.2	6.8	23.2
A4Q3	2N3440								6.3	6.8	102.0
A4Q4	2N3440								6.2	6.7	94.0
A4Q5	2N2270								6.8	7.4	23.2
A6Q1	3N140	13.5	2.7	0.0	0.7						
A6Q2	3N140	17.1	0.0	0.0	0.0						
A6Q3	3N140	17.2	3.7	0.0	0.9						
A7Q1	2N3933								-1.4	-0.7	22.5
A7Q2	2N3933								-10.2	-9.4	-1.6
A8Q1	2N2646	8.0	GND	--	22.5						
A8Q2	2N3251								20.0	19.2	8.0
A8U1	μA741		8.0	8.0	-8.3		8.0	23.2			
A8U2	μA741		5.5	5.5	-17.8		0.0	18.4			
A8U3	μA741		0.0	0.0	-17.8		0.0	18.4			
A8U4	μA741		0.0	0.0	-17.8		0.0	18.4			
A8U5	μA741		0.0	0.0	-17.8		0.0	18.4			

NOTES: (1) Varies with the setting of A4R29.

(2) SM-1622 front panel controls as follows:

INTENSITY - MAX CW
FOCUS - MAX CW
MARKER - ON
SWEEP WIDTH - MAX CW
CENTER FREQ - MAX CW
SWEEP RATE - MAX CW
GAIN - MAX CW
SWEEP, S3, - POS. 2

(3) 115 Vac applied to SM-1622; no signal input. All measurements positive with respect to chassis unless otherwise specified. Measurements taken with an RCA-WV-98C VTVM.

Table 4-3. Typical Module Pin Voltages

PIN	1	2	3	4	5	6	9	10	11	12	13	14	15	16	18	19	22
XA1										-42		55 ac	55 ac		-18.5	-18.5	
XA2			55 ac	55 ac						35.0		24.0	24.0		18.5		
XA4		82.2	189.8	18.4	7.7		9.9	18.4	23.2	23.2	20.9			23.2		189.8	
XA6	18.5			-17.9	3.5	-2.6											
XA7				189.8						23.2				-17.9			
XA8									18.5	-17.9							23.2

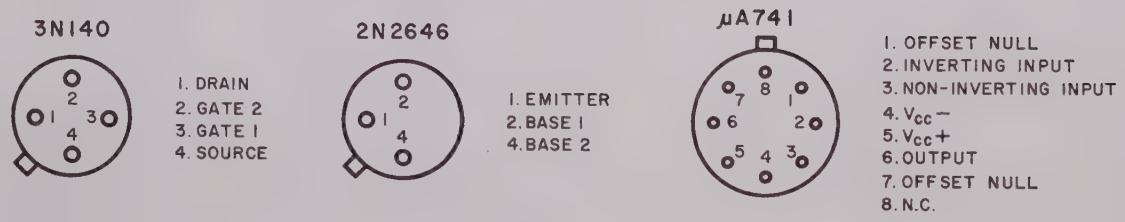


Figure 4-4. Bottom View Pin Locations of Semiconductors

SECTION V

REPLACEMENT PARTS LIST

5.1 UNIT NUMBERING METHOD

The unit numbering method of assigning reference designations (electrical symbol numbers) has been used to identify assemblies, subassemblies (and module), and parts. An example of the unit method follows:

Read from right to left as: First (1) resistor (R) of first (1) subassembly (A)

As shown on the main chassis schematic, components which are an integral part of the main chassis have no subassembly designation.

5.2 REFERENCE DESIGNATION PREFIX

Partial reference designations have been used on the equipment and on the illustrations in this manual. The partial reference designations consist of the class letter(s) and identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Prefixes are provided on drawings and illustrations within the titles in parentheses.

5.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address	Mfr. Code	Name and Address
01121	Allen-Bradley Company 1201 South 2nd Street Milwaukee, Wisconsin 53204	06540	Amatom Electronic Hardware Division of Mite Corporation 81 Rockdale Avenue New Rochelle, New York 10802
02114	Ferroxcube Corporation of America Mt. Marion Road Saugerties, New York 12477	07263	Fairchild Camera & Instrument Corp. Semiconductor Division 313 Frontage Road Mountain View, California 94040
04013	Taurus Corporation 1 Academy Hill Lambertville, New Jersey 08530	07387	The Birtcher Corporation 4371 Valley Boulevard Los Angeles, California 90032
04713	Motorola Semiconductor Products. Inc. 5005 East McDowell Road Phoenix, Arizona 85008	09023	Cornell-Dubilier Electric Corporation Electrolytics & Paper Tubular Division 2562 Dalrymple Sanford, North Carolina 27330
05820	Wakefield Engineering, Inc. Audubon Road Wakefield, Massachusetts 01880	14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, Maryland 20878

Mfr. Code	Name and Address
21604	The Buckeye Stamping Company 555 Marion Road Columbus, Ohio 43207
25088	Siemens America, Inc. 350 5th Avenue New York, New York 10001
27193	Cutler-Hammer, Inc. Special Products Division 4201 N 27th Street Milwaukee, Wisconsin 53216
27956	Relcom 2164 East Middlefield Road Mountain View, California 94040
28480	Hewlett-Packard Company 1501 Page Mill Road Palo Alto, California 94304
56289	Sprague Electric Company Marshall Street North Adams, Massachusetts 01247
71279	Cambridge Thermionic Corporation 445 Concord Avenue Cambridge, Massachusetts 02138
71450	CTS Corporation 1142 West Beardsley Avenue Elkhart, Indiana 46514
71785	Cinch Manufacturing Company Howard B. Jones Division 1026 South Homan Avenue Chicago, Illinois 60624
72619	Dialight Corporation 60 Stewart Avenue Brooklyn, New York 11237
72982	Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania 16512
73138	Beckman Instruments, Inc. Helipot Division 2500 Harbor Boulevard Fullerton, California 92634
74868	Bunker - Ramo Corporation The Amphenol RF Division 33 East Franklin Street Danbury, Connecticut 06810
75042	IRC Division of TRW Incorporated 401 North Broad Street Philadelphia, Pennsylvania 19108
75915	Littelfuse, Incorporated 800 E. Northwest Highway Des Plaines, Illinois 60016
79727	Continental-Wirt Electronics Corp. 26 West Queen Street Philadelphia, Pennsylvania 19144
80131	Electronic Industries Association 2001 Eye Street, N.W. Washington, D.C. 20006
81073	Grayhill Incorporated 561 Hillgrove Avenue LaGrange, Illinois 60525
81349	Military Specifications
82389	Switchcraft, Incorporated 5527 North Elston Avenue Chicago, Illinois 60630
91418	Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, Illinois 60646
92193	United States Smelting Works Inc. Bristol Sts. Philadelphia, Pennsylvania
95121	Quality Components, Inc. P.O. Box 113 St. Mary's, Pennsylvania 15857
99848	Wilco Corporation 4030 West 10th Street P.O. Box 22248 Indianapolis, Indiana 46222

5.4 PARTS LIST

When ordering replacement parts from CEI Division, specify the type and serial number of the equipment, and the reference designation and description of each part ordered. The Manufacturers and Manufacturer's Part Numbers listed are included as a guide to the user of the equipment in the field and do not necessarily agree with the parts installed in the equipment. Except in those cases specifically noted, the replacement part may be obtained from any manufacturer as long as the physical and electrical parameters of the part selected agree with the original part.

NOTE

As improved semiconductors become available it is the policy of CEI Division to incorporate them in proprietary products. For this reason some transistors, diodes, and integrated circuits installed in the equipment may not agree with those specified in the parts lists and schematic diagrams of this manual. However, the semiconductors designated in the manual may be substituted in every case with satisfactory results.

5.4.1 Type SM-1622 Signal Monitor, Main Chassis

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	-18V REGULATED POWER SUPPLY	1	76168	14632
A2	+18V AND +24V REGULATED POWER SUPPLY	1	76166	14632
A3	160 MHz TUNER	1	71290	14632
A4	HORIZONTAL AMPLIFIER	1	8241	14632
A5	FOCUS AND INTENSITY BOARD	1	13488	14632
A6	IF AMPLIFIER	1	8026	14632
A7	OUTPUT AMPLIFIER	1	8138	14632
A8	SWEEP GENERATOR	1	8243	14632
A9	BANDPASS FILTER	1	79750	14632
DS1	LAMP, NEON	1	249-7866-1431-534	72619
F1	FUSE, 3AG, SLOW-BLOW: 1/8A	1	F02B250V1/8A	81349
F2	FUSE, 3AG, SLOW-BLOW: 1/16A	1	F02B250V1/16A	81349
FL1	FILTER, POWER	1	JN33-694B	56289
J1	CONNECTOR, JACK, BNC SERIES Part of W1	1	17825	74868
J2	CONNECTOR, RECEPTACLE, BNC SERIES	2	UG-1094/U	81349
J3	Same as J2			
MP1	KNOB	4	PS50D1(Light Gray)	21604
MP2	Same as MP1			
MP3	Same as MP1			
MP4	Same as MP1			
MP5	KNOB	2	PS50PL1(Light Gray)	21604
MP6	Same as MP5			
MP7	SCREW, PANEL FASTENER	2	6105B0832	06540
MP8	Same as MP7			
MP9	SHIELD, ELECTRON TUBE	1	31310-1	14632
MP10	SCALE, CRT	1	1425	14632
P1	CONNECTOR, PLUG, MB SERIES Part of W1	4	44950	74868
P2	Same as P1			
P3	Same as P1 Part of W2			
P4	Same as P1 Part of W2			
PS1	DC-DC CONVERTER	1	76144	14632
R1	RESISTOR, VARIABLE, COMPOSITION: 10 kΩ, 10%, 1/2W	3	LW23562	71450
R2	RESISTOR, FIXED, COMPOSITION: 24 kΩ, 5%, 1/4W	1	RCR07G243JS	81349
R3	Same as R1			

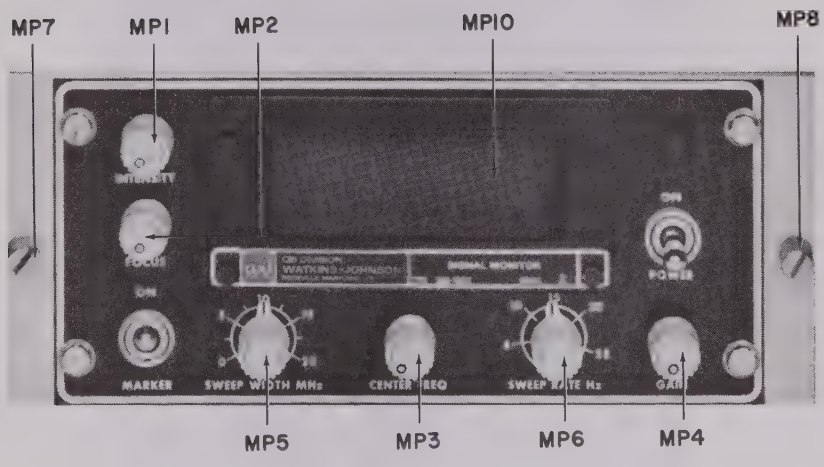


Figure 5-1. Type SM-1622 Signal Monitor, Front View, Location of Components

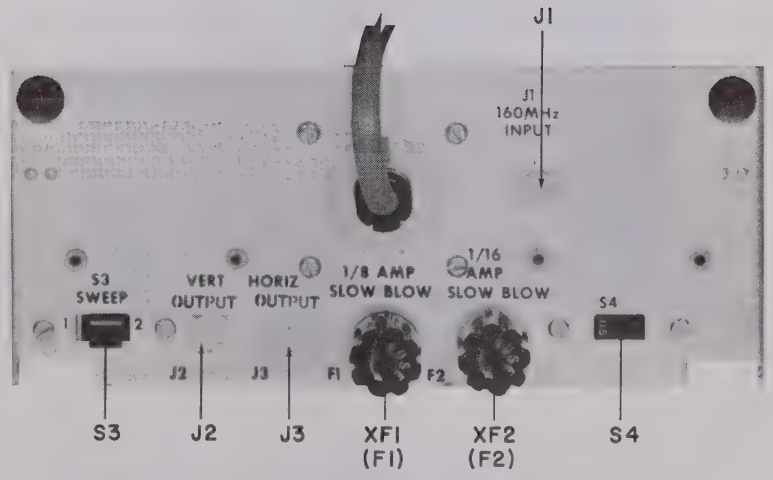


Figure 5-2. Type SM-1622 Signal Monitor, Rear View, Location of Components

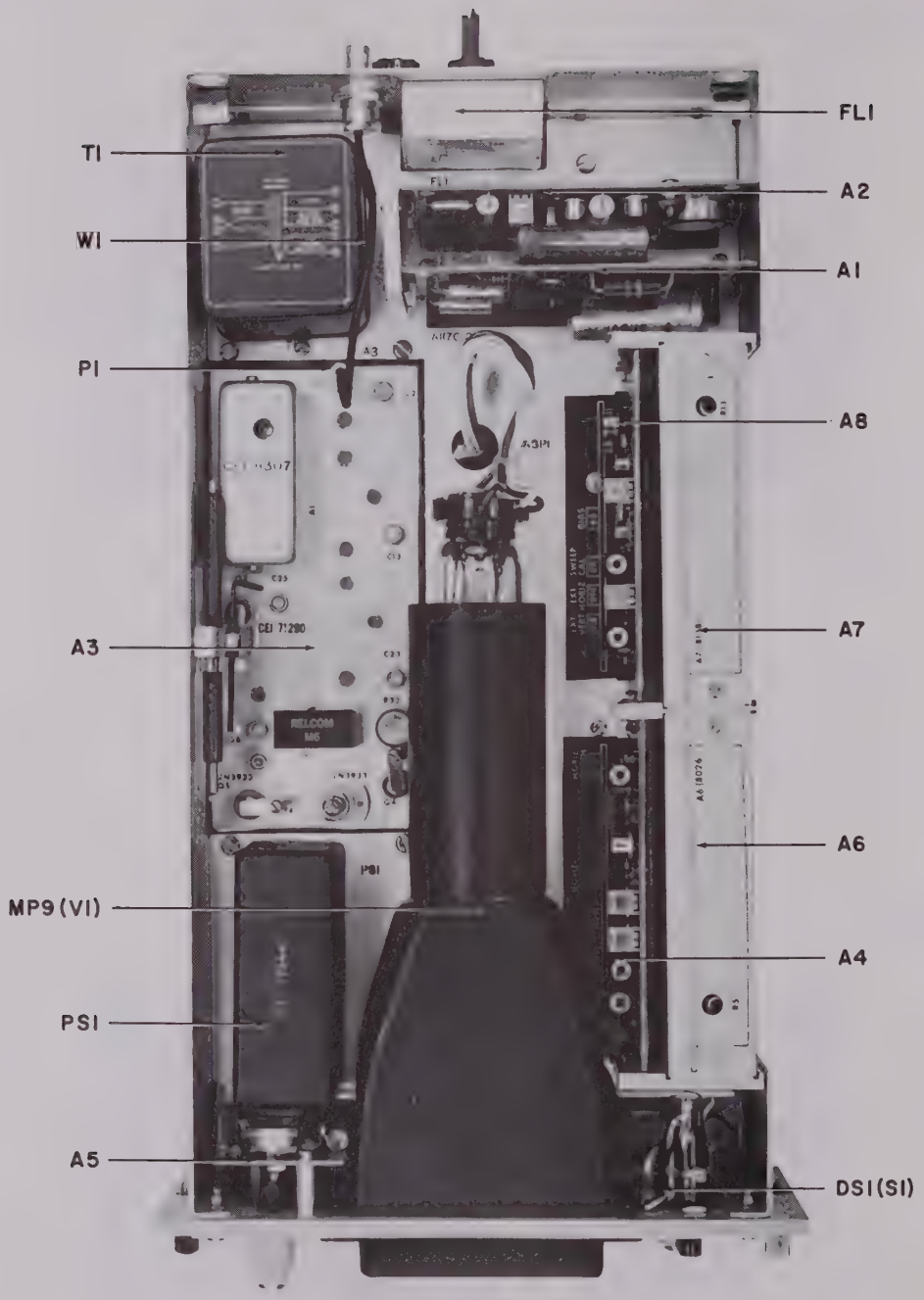


Figure 5-3. Type SM-1622 Signal Monitor, Top View, Location of Components

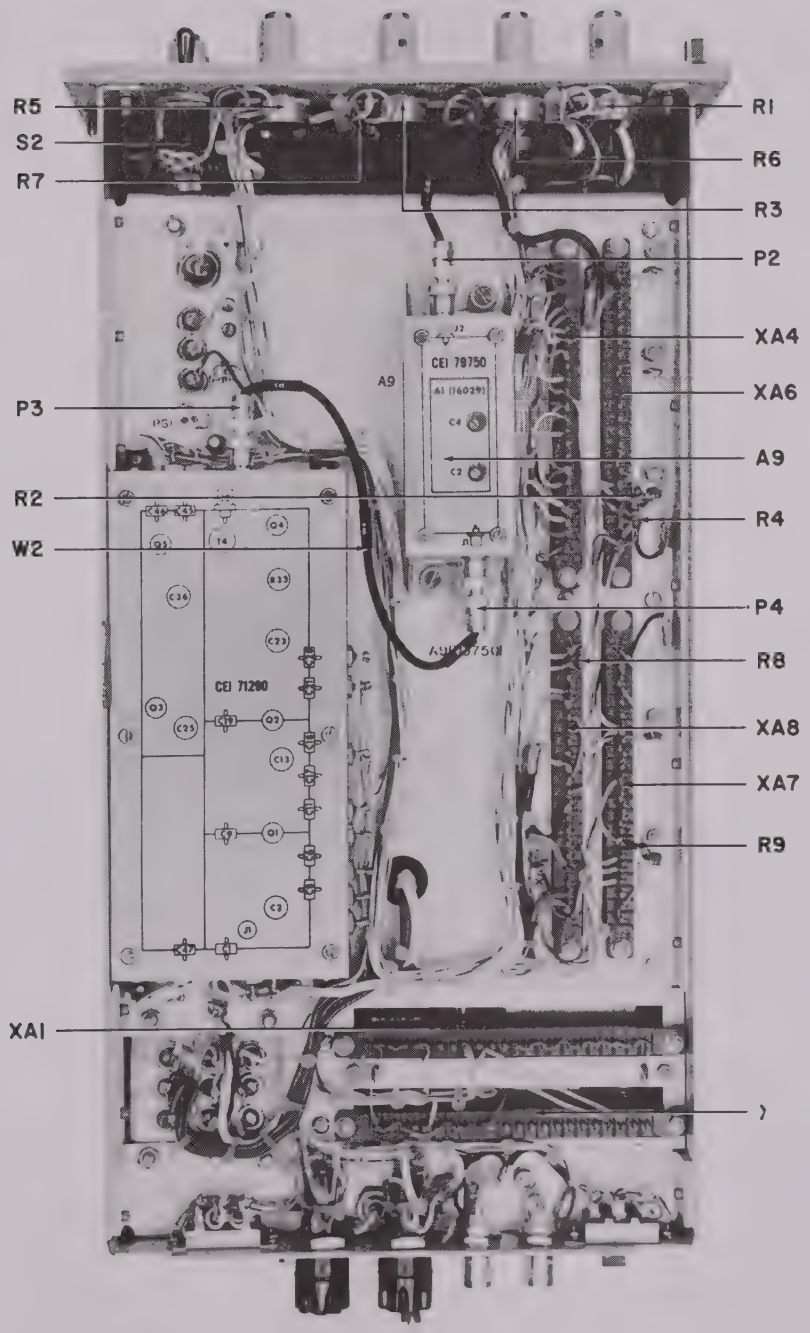


Figure 5-4. Type SM-1622 Signal Monitor, Bottom View, Location of Components

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R4*	Same as R2			
R5	RESISTOR, VARIABLE, COMPOSITION: 50 kΩ, 10%, 1/2W	1	NX24430	71450
R6	Same as R1			
R7	RESISTOR, FIXED, COMPOSITION: 91 kΩ, 5%, 1/4W	1	RCR07G913JS	81349
R8*	RESISTOR, FIXED, COMPOSITION: 39 kΩ, 5%, 1/4W	1	RCR07G393JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 200 kΩ, 5%, 1/4W	1	RCR07G204JS	81349
R10	RESISTOR, FIXED, COMPOSITION: 5.1 kΩ, 5%, 1/4W	1	RCR07G512JS	81349
R11	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	1	RCR07G682JS	81349
S1	SWITCH, TOGGLE SPST	2	8280-K16	27193
S2	Same as S1			
S3	SWITCH, SLIDE, DPDT	1	G326	79727
S4	SWITCH, SLIDE, DPDT	1	11A1211	82389
T1	TRANSFORMER	1	13500	14632
V1	TUBE, CATHODE RAY	1	3ASP1	80131
W1	CONNECTOR AND CABLE ASSEMBLY	1	30020-1260	14632
W2	CONNECTOR AND CABLE ASSEMBLY	1	30020-1261	14632
XA1	CONNECTOR, PRINTED CIRCUIT CARD	6	250-22-30-170	71785
XA2	Same as XA1			
XA4	Same as XA1			
XA6	Same as XA1			
XA7	Same as XA1			
XA8	Same as XA1			
XF1	FUSEHOLDER	2	342004	75915
XF2	Same as XF1			

* Nominal value. Final value factory selected.

5.4.2 Type 76168 -18 V Regulated Power Supply

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, ELECTROLYTIC, ALUMINUM: 200 μF, -10+75%, 50 V	1	39D207G050FJ4	56289
C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μF, 10%, 35 V	2	CS13BF226K	81349
C3	Same as C2			
CR1	DIODE	2	1N4003	80131
CR2	DIODE	1	1N967B	80131
CR3	DIODE	2	1N462A	80131
CR4	Same as CR3			
CR5	Same as CR1			
Q1	TRANSISTOR	2	2N4037	80131
Q2	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 2W	2	RC42GF221J	81349
R2	RESISTOR, FIXED, COMPOSITION: 5.1 kΩ, 5%, 1/4W	2	RCR07G512JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	1	RCR07G182JS	81349
R4	Same as R1			
R5	Same as R2			
R6	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	2	RCR07G183JS	81349
R7	Same as R6			
RA1	RADIATOR, TRANSISTOR	1	3AL635-2R	07387

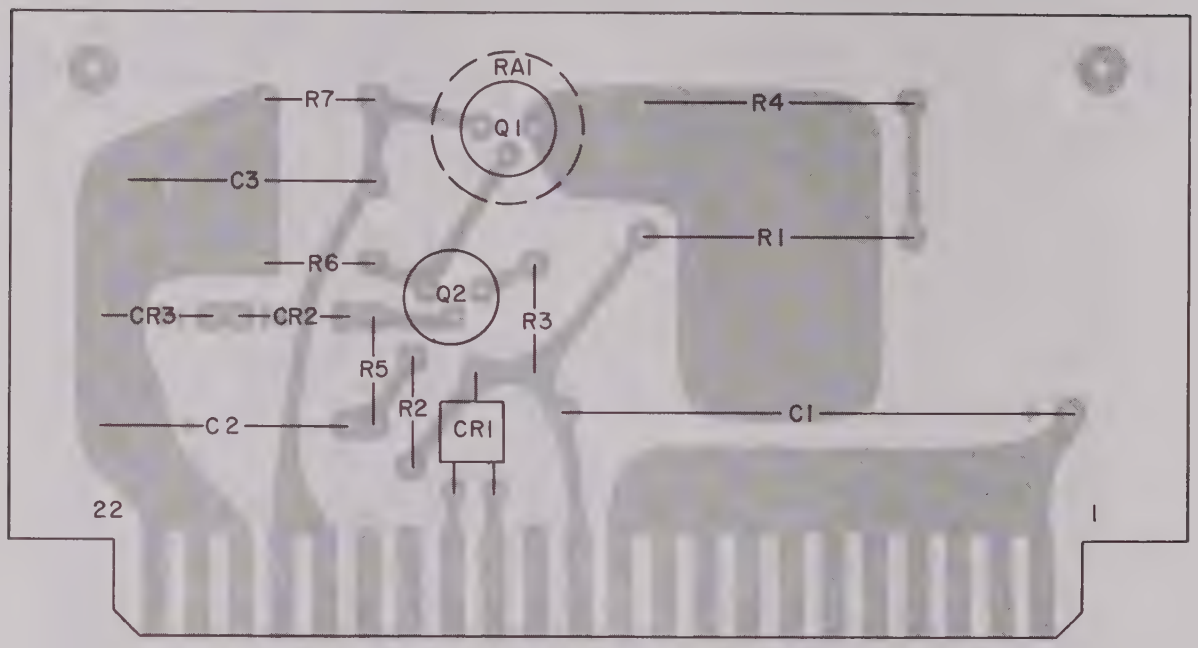


Figure 5-5. Type 76168 -18V Regulated Power Supply (A1), Location of Components

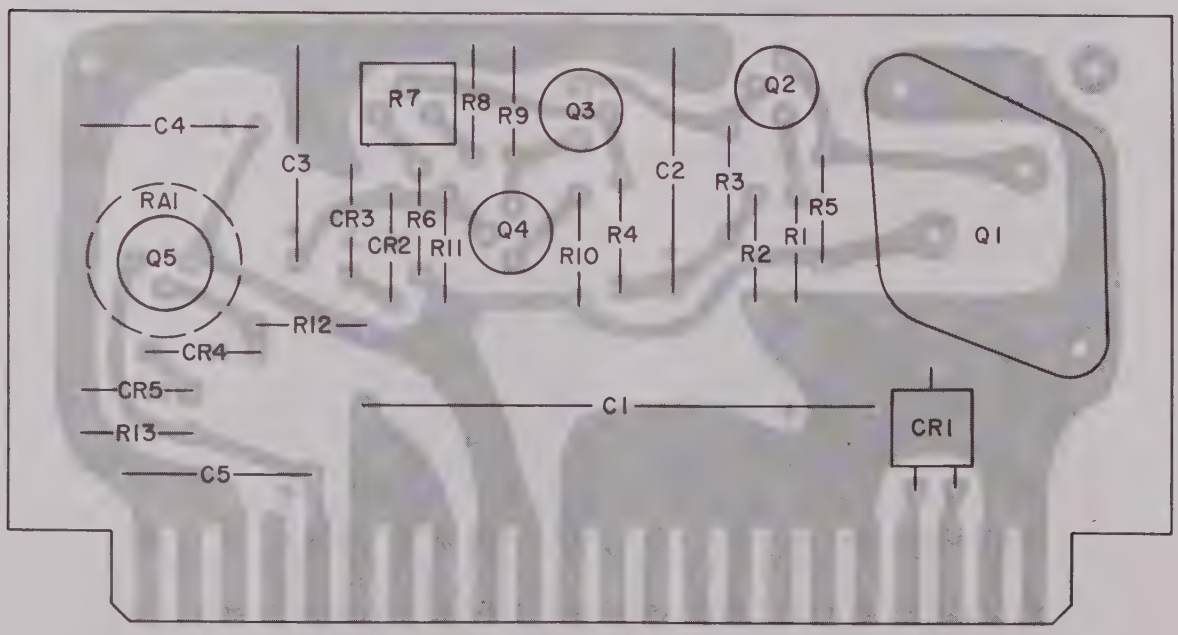


Figure 5-6. Type 76166 +18V and +24V Regulated Power Supply (A2), Location of Components

5.4.3 Type 76166 +18V & +24V Regulated Power Supply

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, ELECTROLYTIC, ALUMINUM: 200 μF, -10+75%, 50V	1	39D207G050FJ4	56289
C2	CAPACITOR, ELECTROLYTIC, ALUMINUM: 10 μF, -10+75%, 50V	1	30D106G050CB2	56289
C3	CAPACITOR, ELECTROLYTIC, ALUMINUM: 10 μF, -10+75%, 25V	1	30D106G025BB2	56289
C4	CAPACITOR, ELECTROLYTIC, TANTALUM: 6.8 μF, 10%, 35V	2	CS13BF685K	81349
C5	Same as C4			
CR1	DIODE	1	MDA940A-3	04713
CR2	DIODE	1	1N754A	80131
CR3	DIODE	2	1N462A	80131
CR4	DIODE	1	1N967B	80131
CR5	Same as CR3			
Q1	TRANSISTOR	1	2N3055	80131
Q2	TRANSISTOR	4	2N2270	80131
Q3	Same as Q2			
Q4	Same as Q2			
Q5	Same as Q2			
R1	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	RCR07G470JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	2	RCR07G682JS	81349
R3	Same as R2			
R4	RESISTOR, FIXED, COMPOSITION: 270 kΩ, 5%, 1/4W	1	RCR07G274JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	1	RCR07G102JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 9.1 kΩ, 5%, 1/4W	1	RCR07G912JS	81349
R7	RESISTOR, VARIABLE, FILM: 1 kΩ, 30%, 1/2W	1	62PAR1K	73138
R8	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	1	RCR07G392JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 1.5 kΩ, 5%, 1/4W	2	RCR07G152JS	81349
R10	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	1	RCR07G221JS	81349
R11	RESISTOR, FIXED, COMPOSITION: 8.2 kΩ, 5%, 1/4W	1	RCR07G822JS	81349
R12	Same as R9			
R13	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	1	RCR07G183JS	81349
RA1	RADIATOR, TRANSISTOR	1	NF207	05820
RA2*	RADIATOR, TRANSISTOR	1	6103B	13103

* RA2 consists of Part No. 6103B top only.

5.4.4 Type 71290 160-MHz Tuner

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	160 MHz MARKER OSCILLATOR	1	8307	14632
C1	CAPACITOR, CERAMIC, FEEDTHRU: 470 pF, 20%, 500V	14	FA5C-4712	01121
C2	CAPACITOR, VARIABLE, AIR: 0.8-10 pF, 250V	4	2954	92193
C3	NOT USED			
C4	CAPACITOR, CERAMIC, DISC: 470 pF, 20%, 1000V	9	B(470pF, M)	91418
C5	CAPACITOR, CERAMIC, STANDOFF: 470 pF, 20%, 500V	12	SS5D-4712	01121
C6	Same as C1			
C7	Same as C5			
C8	Same as C1			
C9	Same as C1			
C10	Same as C5			
C11	Same as C1			
C12	Same as C4			
C13	Same as C2			
C14	Same as C4			
C15	Same as C5			
C16	CAPACITOR, MICA, DIPPED: 10 pF, ±0.5 pF, 500V	1	CM05CD100D03	81349
C17	Same as C1			
C18	Same as C1			
C19	Same as C1			
C20	Same as C5			
C21	Same as C1			
C22	Same as C1			
C23	Same as C2			
C24	Same as C4			
C25	NOT USED			
C26	Same as C4			
C27	Same as C5			
C28	Same as C1			
C29	Same as C5			
C30	Same as C5			
C31	Same as C4			
C32	Same as C5			

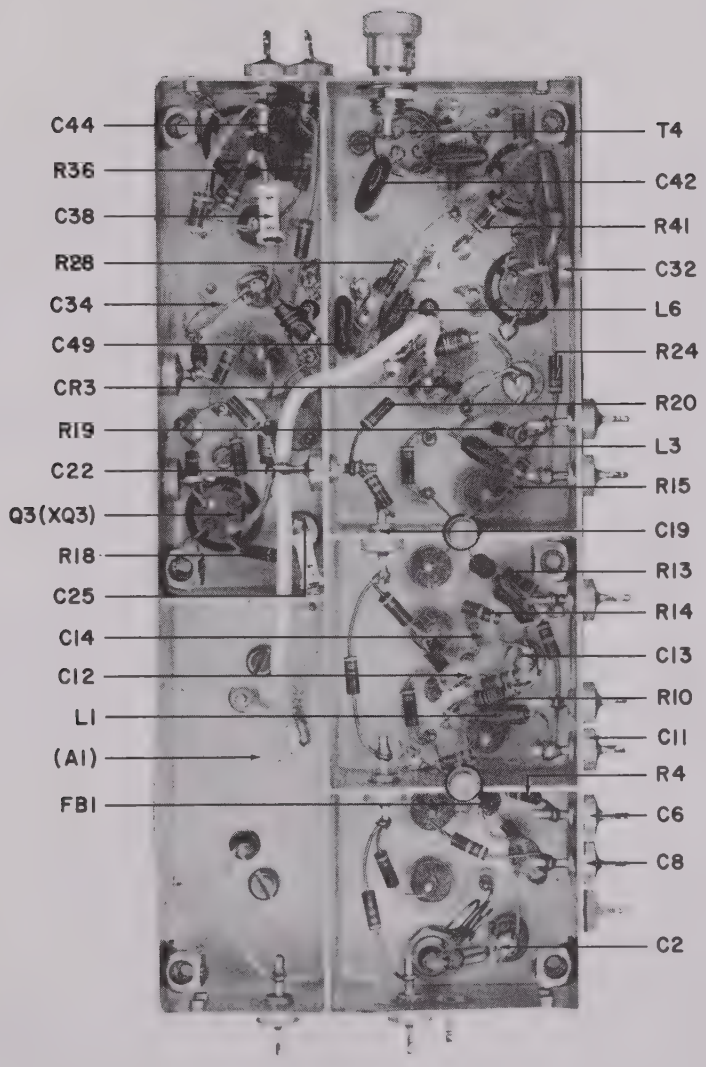


Figure 5-7. Type 71290 160-MHz Tuner (A3), Location of Components

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C33	Same as C4			
C34	Same as C4			
C35	Same as C5			
C36	Same as C2			
C37	Same as C4			
C38	CAPACITOR, CERAMIC, TUBULAR: 10 pF, ±0.5 pF, 500V	1	301-000-C0H0-100D	72982
C39	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100V	1	C023B101E502M	56289
C40	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V	1	SM(1000pF, GMV)	91418
C41	CAPACITOR, MICA, DIPPED: 130 pF, 5%, 500V	2	CM05FD131J03	81349
C42	Same as C41			
C43	CAPACITOR, MICA, DIPPED: 20 pF, 5%, 500V	1	CM05ED200J03	81349
C44	CAPACITOR, MICA, DIPPED: 15 pF, 5%, 500V	1	CM05CD150J03	81349
C45	Same as C1			
C46	Same as C1			
C47	Same as C1			
C48	CAPACITOR, CERAMIC, STANDOFF: 1000 pF, GMV, 500 V	1	SS5D-102W	01121
C49	CAPACITOR, MICA, DIPPED: 220 pF, 5%, 500 V	1	CM05FD221J03	81349
C50	CAPACITOR, COMPOSITION, TUBULAR: 0.68 pF, 10%, 500 V	1	QC(.68pF, K)	95121
C51	NOT USED			
C52	Same as C5			
CR1	NOT USED			
CR2	DIODE	3	BB105B	25088
CR3	Same as CR2			
CR4	Same as CR2			
FB1	FERRITE BEAD	2	56-590-65/4A	02114
FB2	Same as FB1			
J1	CONNECTOR, RECEPTACLE, MB SERIES	2	46025	74868
J2	Same as J1			
L1	INDUCTOR, FIXED: 1.0 μH	2	205-11	99848
L2	INDUCTOR, FIXED	1	1131-72	14632
L3	Same as L1			
L4	COIL, FIXED	1	1129-41	14632

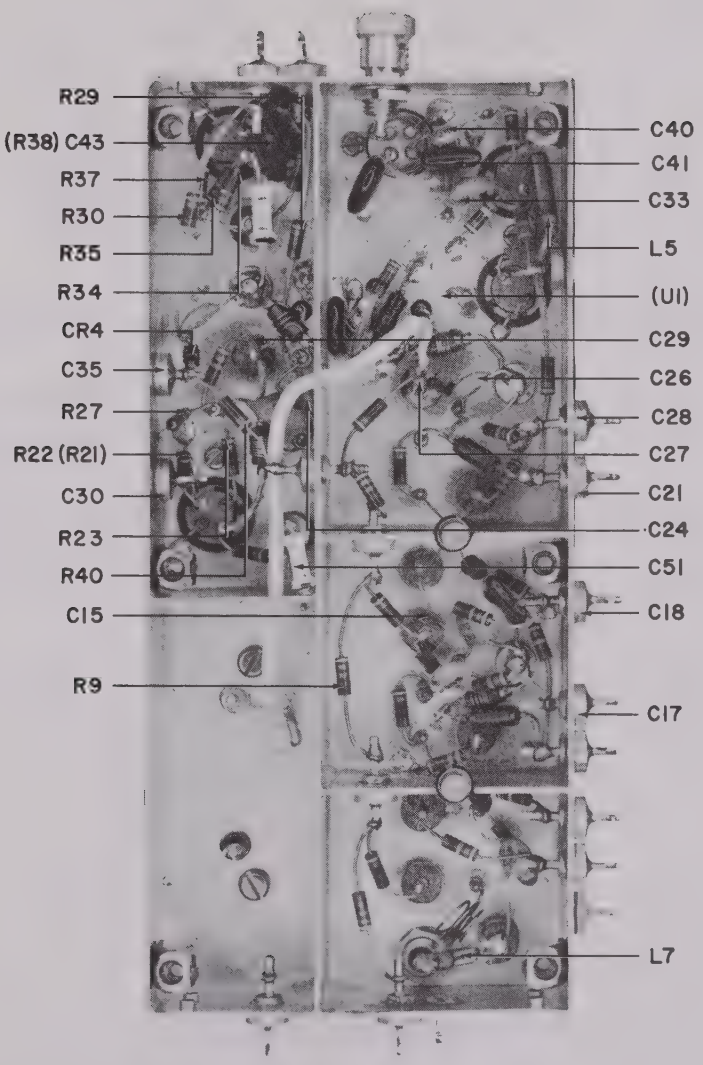


Figure 5-8. Type 71290 160-MHz Tuner (A3), Location of Components

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
L5	INDUCTOR, FIXED	1	1131-37	14632
L6	INDUCTOR, FIXED: 0.24 μH	2	200-11	99848
L7	INDUCTOR, FIXED	1	21210-36	14632
MP1	COVER	1	15813-1	14632
Q1	TRANSISTOR	2	3N187	80131
Q2	Same as Q1			
Q3	TRANSISTOR	2	2N2857	80131
Q4	TRANSISTOR	1	2N3478	80131
Q5	Same as Q3			
R1	RESISTOR, FIXED, COMPOSITION: 2.7 Ω, 5%, 1/4W	3	RCR07G2R7JS	81349
R2	NOT USED			
R3	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	4	RCR07G222JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 150 kΩ, 5%, 1/4W	2	RCR07G154JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 20 kΩ, 5%, 1/4W	2	RCR07G203JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	2	RCR07G103JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	2	RCR07G331JS	81349
R8	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	5	RCR07G100JS	81349
R9	Same as R1			
R10	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	2	RCR07G223JS	81349
R11	Same as R3			
R12	Same as R4			
R13	Same as R5			
R14	Same as R6			
R15	Same as R7			
R16	Same as R8			
R17	Same as R1			
R18	NOT USED			
R19	Same as R10			
R20	Same as R3			
R21	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	2	RCR07G182JS	81349
R22	RESISTOR, FIXED, COMPOSITION: 27 Ω, 5%, 1/4W	1	RCR07G270JS	81349
R23	Same as R8			
R24	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	4	RCR07G101JS	81349
R25	NOT USED			
R26	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	4	RCR07G183JS	81349

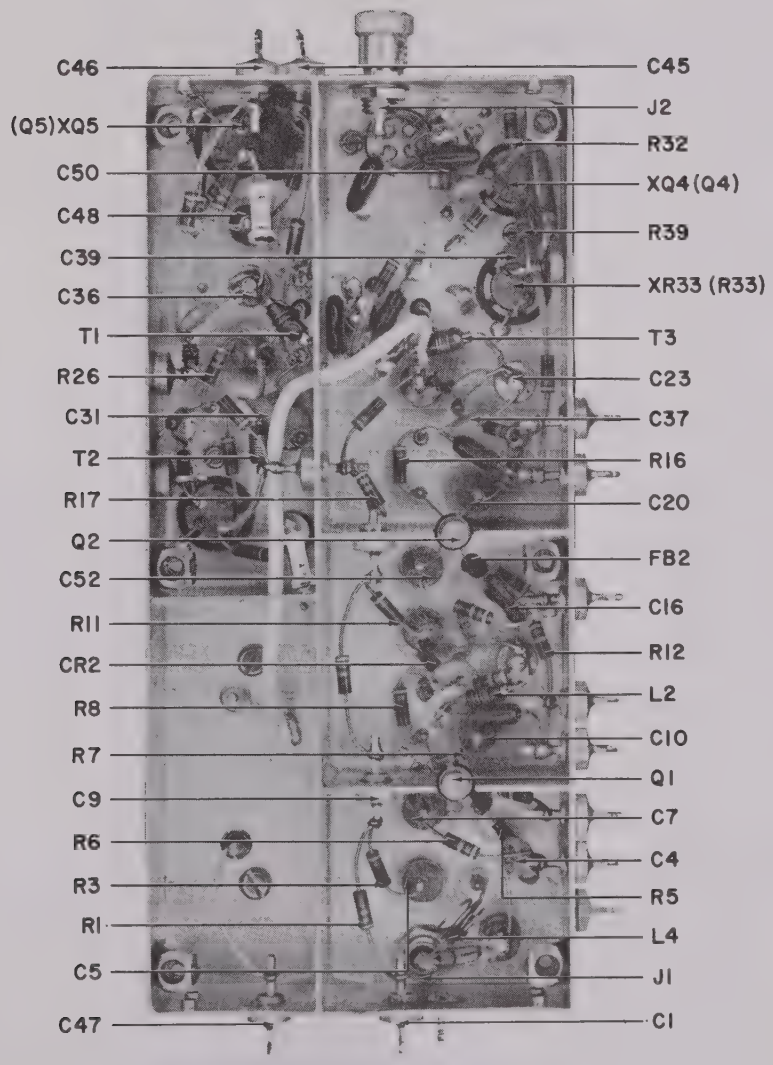


Figure 5-9. Type 71290 160-MHz Tuner (A3), Location of Components

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R27	Same as R26			
R28	Same as R24			
R29	Same as R24			
R30	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349
R31	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	1	RCR07G102JS	81349
R32	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	RCR07G470JS	81349
R33	RESISTOR, VARIABLE, WIRE-WOUND: 100 Ω, 5%, 1W	1	100(100Ω, J)	75042
R34	Same as R26			
R35	Same as R26			
R36	Same as R24			
R37	Same as R8			
R38	Same as R21			
R39	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	RCR07G153JS	81349
R40	Same as R3			
R41	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	1	RCR07G392JS	81349
T1	TRANSFORMER	2	11464-60	14632
T2	TRANSFORMER	1	11464-27	14632
T3	TRANSFORMER	1	11464-41	14632
T4	TRANSFORMER, VARIABLE	1	13106	14632
XQ3	SOCKET, TRANSISTOR	3	22-16-4	81073
XQ4	Same as XQ3			
XQ5	Same as XQ3			
XQ33	SOCKET, RESISTOR	1	22-16-2	81073
U1	BALANCED MIXER	1	M6	27956

5.4.4.1 Type 8307 160 MHz Marker Oscillator REF DESIG PREFIX A3A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	160 MHz MARKER OSCILLATOR BOARD	1	15830	14632
C1	CAPACITOR, CERAMIC, FEEDTHRU	1	FA5C-4712	01121
E1	TERMINAL, FEEDTHRU	1	SFU-16	04013

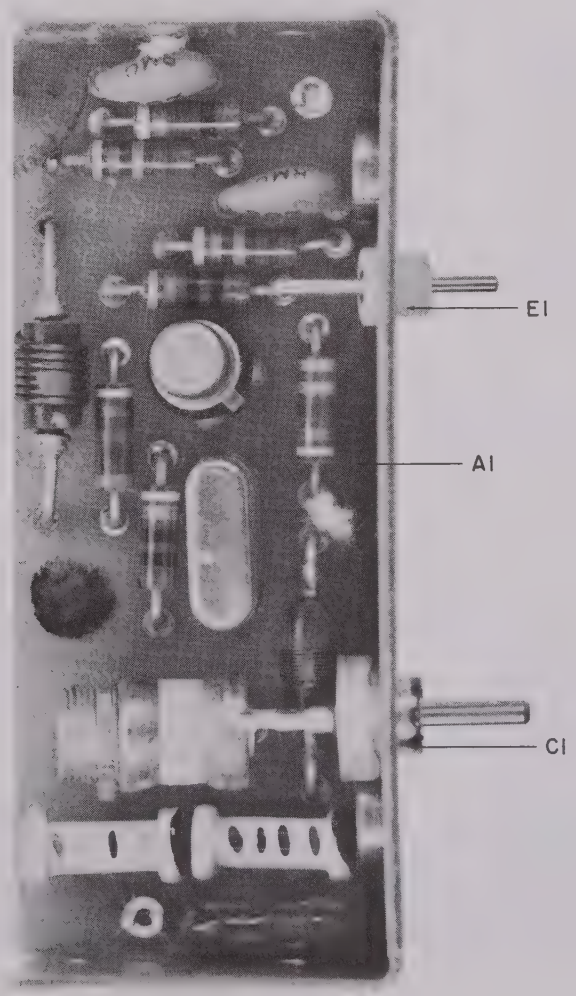


Figure 5-10. Type 8307 160-MHz Marker Oscillator (A3A1), Location of Components

5.4.4.1.1 Part 15830 160 MHz Marker Oscillator Board REF DESIG PREFIX A3A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, DISC: 470 pF, 20%, 1000V	2	B(470pF, M)	91418
C2	Same as C1			
C3	CAPACITOR, VARIABLE, AIR: 0.8-10 pF, 250V	1	2951	92193
C4	CAPACITOR, CERAMIC, TUBULAR: 10 pF, ±0.5 pF, 500V	1	301-000-C0H0-100D	72982
C5	CAPACITOR, CERAMIC, TUBULAR: 3.0 pF, ±0.25 pF, 500V	1	301-000-C0J0-309C	72982
C6	CAPACITOR, MICA, DIPPED: 47 pF, 5%, 500V	1	CM05ED470J03	81349
L1	INDUCTOR, FIXED	1	21210-83	14632
L2	INDUCTOR, FIXED: 0.24 μH	1	200-11	99848
Q1	TRANSISTOR	1	2N3478	80131
R1	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	1	RCR07G102JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	2	RCR07G183JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	2	RCR07G100JS	81349
R4	Same as R2			
R5	Same as R3			
R6	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	1	RCR07G332JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 620 Ω, 5%, 1/4W	1	RCR07G621JS	81349
Y1	CRYSTAL, QUARTZ: 160 MHz	1	98203-01	14632

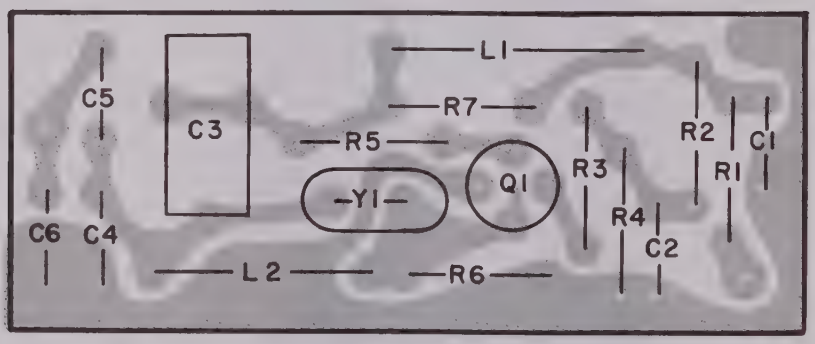


Figure 5-11. Part 15830 160-MHz Marker Oscillator Board (A3A1A1), Location of Components

5.4.5 Type 8241 Horizontal Amplifier

REF DESIG PREFIX A4

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
CR1	DIODE	2	1N462A	80131
CR2	Same as CR1			
Q1	TRANSISTOR	3	2N2270	80131
Q2	Same as Q1			
Q3	TRANSISTOR	2	2N3440	80131
Q4	Same as Q3			
Q5	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 220 kΩ, 5%, 1/4W	3	RCR07G224JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	1	RCR07G182JS	81349
R3	RESISTOR, VARIABLE, FILM: 200 kΩ, 30%, 1/2W	1	62PAR200K	73138
R4	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	4	RCR07G104JS	81349
R5	Same as R4			
R6	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	2	RCR07G472JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	4	RCR07G153JS	81349
R8	Same as R1			
R9	Same as R7			
R10	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	1	RCR07G682JS	81349
R11	Same as R1			
R12	Same as R7			
R13	Same as R7			
R14	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	3	RCR07G223JS	81349
R15	Same as R14			
R16	Same as R14			
R17	RESISTOR, FIXED, COMPOSITION: 30 kΩ, 5%, 1/4W	1	RCR07G303JS	81349
R18	RESISTOR, VARIABLE, FILM: 10 kΩ, 30%, 1/2W	2	62PAR10K	73138
R19	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349
R20	RESISTOR, FIXED, COMPOSITION: 56 kΩ, 5%, 1/4W	1	RCR07G563JS	81349
R21	RESISTOR, FIXED, COMPOSITION: 8.2 kΩ, 5%, 1/4W	1	RCR07G822JS	81349
R22	RESISTOR, FIXED, COMPOSITION: 130 kΩ, 5%, 1/4W	1	RCR07G134JS	81349
R23	RESISTOR, FIXED, COMPOSITION: 240 kΩ, 5%, 1/4W	2	RCR07G244JS	81349
R24	Same as R23			
R25	Same as R4			
R26	RESISTOR, VARIABLE, FILM: 500 kΩ, 30%, 1/2W	2	62PAR500K	73138
R27	Same as R4			

REF DESIG PREFIX A4

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R28	Same as R26			
R29	Same as R18			
R30	Same as R6			
R31	RESISTOR, FIXED, COMPOSITION: 330 kΩ, 5%, 1/4W	2	RCR07G334JS	81349
R32	Same as R31			
VR1	VOLTAGE REGULATOR	1	1N756A	80131
VR2	VOLTAGE REGULATOR	1	1N746A	80131
VR3	VOLTAGE REGULATOR	1	1N749A	80131

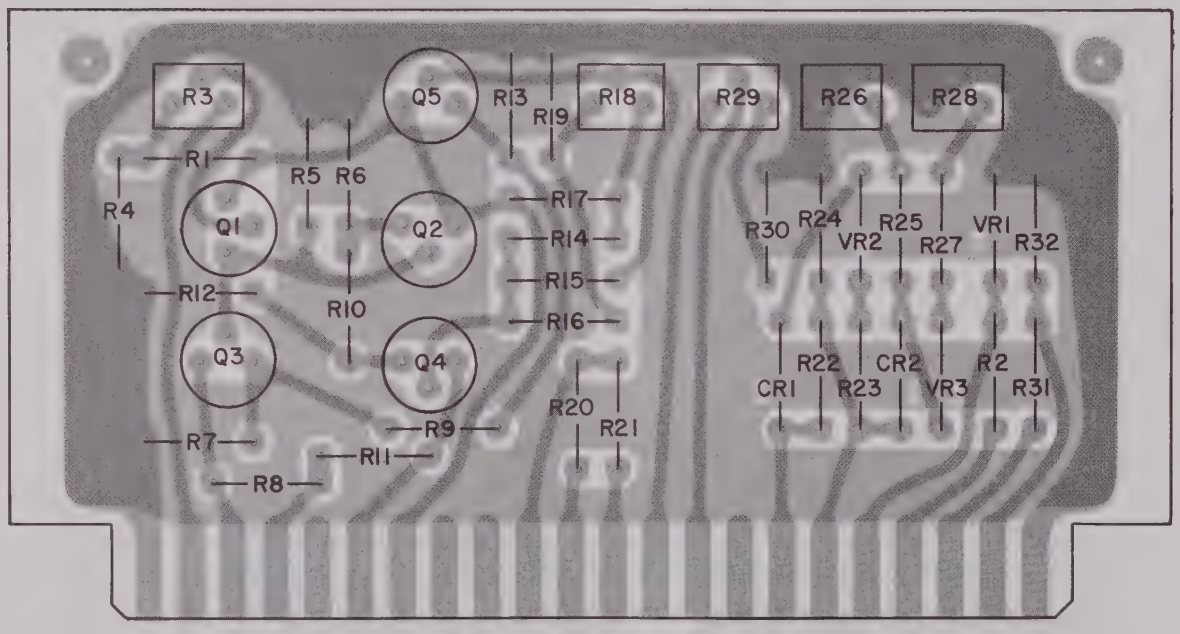


Figure 5-12. Type 8241 Horizontal Amplifier (A4), Location of Components

5.4.6 Part 13488 Focus and Intensity Board REF DESIG PREFIX A5

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, MYLAR, TUBULAR: 0.1 μF, 10%, 100V	1	WMF1P1	09023
R1	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	1	RCR07G104JS	81349
R2	RESISTOR, VARIABLE, COMPOSITION: 500 kΩ, 10%, 1/2W	1	RV5NAYSD504A	81349
R3	RESISTOR, FIXED, COMPOSITION: 3.3 MΩ, 5%, 1/2W	1	RCR20G335JS	81349
R4	RESISTOR, VARIABLE, COMPOSITION: 2.5 MΩ, 20%, 1W	1	70A3N056L255M	01121
R5	RESISTOR, FIXED, COMPOSITION: 3.9 MΩ, 5%, 1/2W	1	RCR20G395JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 4.7 MΩ, 5%, 1/4W	1	RCR07G475JS	81349

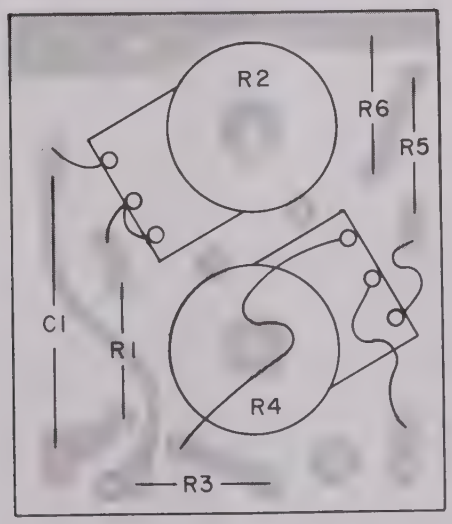


Figure 5-13. Part 13488 Focus and Intensity Board (A5), Location of Components

5.4.7 Type 8026 IF Amplifier

REF DESIG PREFIX A6

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, MICA, DIPPED: 75 pF, 5%, 500V	1	CM05ED750J03	81349
C2	CAPACITOR, MICA, DIPPED: 2200 pF, 5%, 500V	2	CM06FD222J03	81349
C3	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100V	13	C023B101E502M	56289
C4	Same as C3			
C5	Same as C3			
C6	Same as C3			
C7	CAPACITOR, MICA, DIPPED: 100 pF, 5%, 500V	2	CM05FD101J03	81349
C8	CAPACITOR, MICA, DIPPED: 300 pF, 5%, 500V	2	CM05FD301J03	81349
C9	Same as C3			
C10	Same as C3			
C11	Same as C3			
C12	Same as C3			
C13	Same as C7			
C14	Same as C8			
C15	Same as C3			
C16	Same as C3			
C17	Same as C3			
C18	Same as C3			
C19	Same as C3			
C20	CAPACITOR, MICA, DIPPED: 82 pF, 5%, 500V	1	CM05ED820J03	81349
C21	Same as C2			
CR1	DIODE	3	1N462A	80131
CR2	Same as CR1			
CR3	Same as CR1			
L1	COIL, VARIABLE	4	7107-11	71279
L2	Same as L1			
L3	Same as L1			
L4	Same as L1			
L5	COIL, FIXED	1	1131-37	14632
Q1	TRANSISTOR	3	3N187	80131
Q2	Same as Q1			
Q3	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	2	RCR07G103JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 30 kΩ, 5%, 1/4W	3	RCR07G303JS	81349

REF DESIG PREFIX A6

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R3	RESISTOR, FIXED, COMPOSITION: 120 kΩ, 5%, 1/4W	3	RCR07G124JS	81349
R4	Same as R1			
R5	RESISTOR, VARIABLE, FILM: 50 kΩ, 30%, 1/2W	1	62PAR50K	73138
R6	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	3	RCR07G470JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	3	RCR07G100JS	81349
R8	RESISTOR, FIXED, COMPOSITION: 9.1 kΩ, 5%, 1/4W	2	RCR07G912JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	4	RCR07G102JS	81349
R10	Same as R3			
R11	Same as R2			
R12	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	2	RCR07G104JS	81349
R13	Same as R8			
R14	Same as R9			
R15	Same as R6			
R16	Same as R7			
R17*	RESISTOR, FIXED, COMPOSITION: 7.5 kΩ, 5%, 1/4W	2	RCR07G752JS	81349
R18	Same as R9			
R19	Same as R3			
R20	Same as R2			
R21	Same as R12			
R22	Same as R6			
R23	Same as R7			
R24*	Same as R17			
R25	Same as R9			

* Nominal value; Final value factory selected.

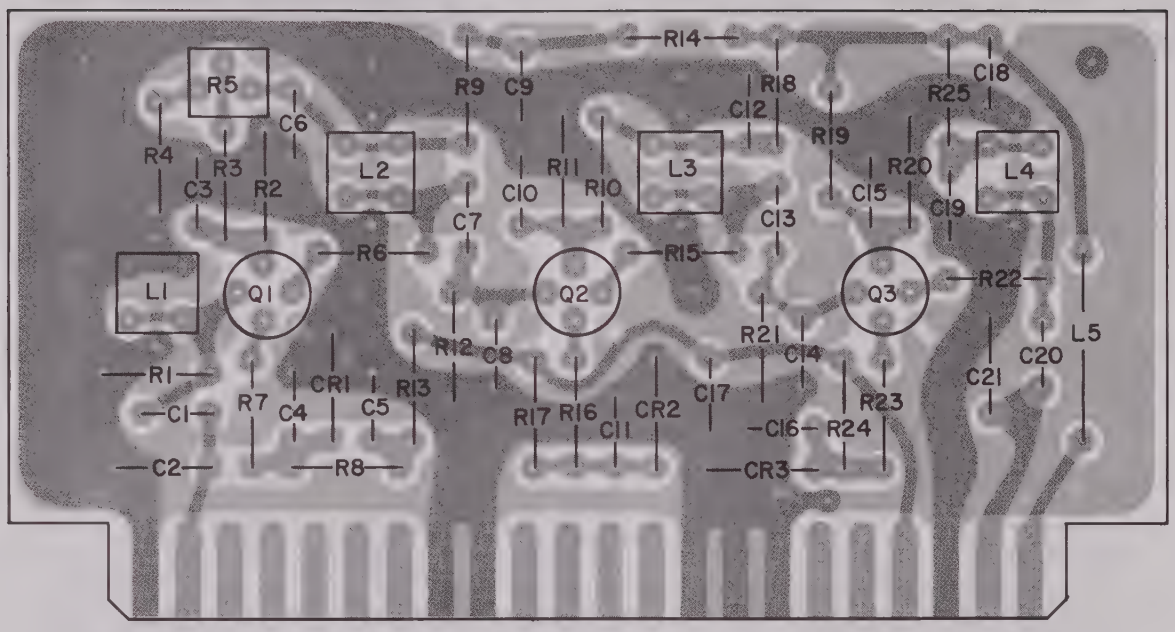


Figure 5-14. Type 8026 IF Amplifier (A6), Location of Components

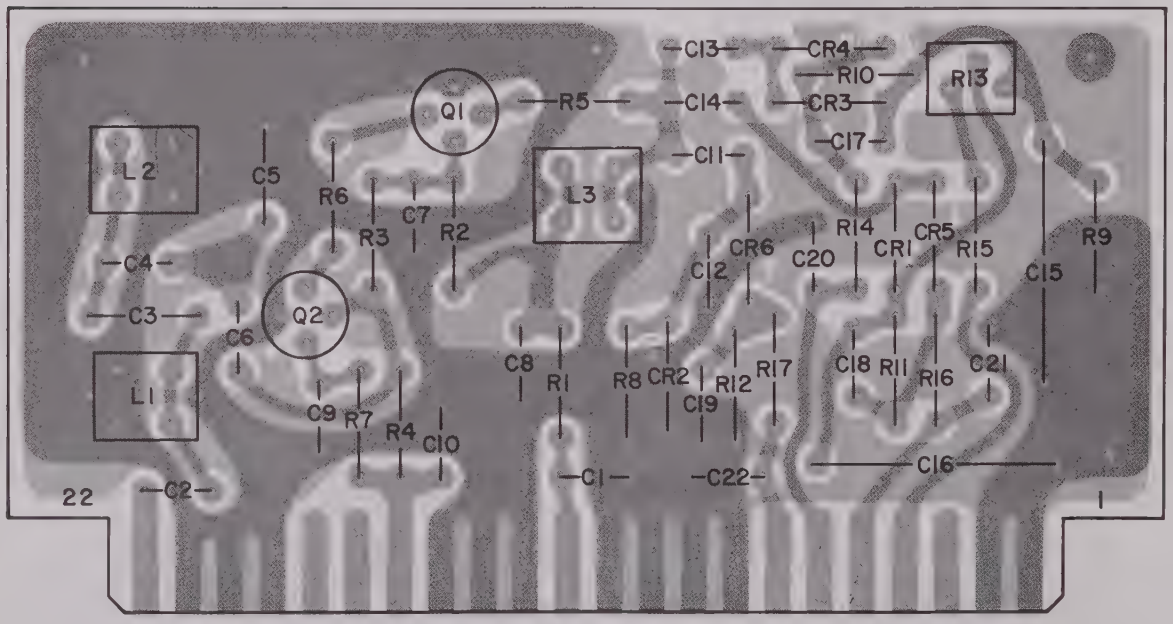


Figure 5-15. Type 8138 Output Amplifier (A7), Location of Components

5.4.8 Type 8138 Output Amplifier

REF DESIG PREFIX A7

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100V	6	C023B101E502M	56289
C2	CAPACITOR, MICA, DIPPED: 82 pF, 5%, 500V	1	CM05ED820J03	81349
C3	CAPACITOR, COMPOSITION, TUBULAR: 3.3 pF, 10%, 500V	1	QC(3.3pF,K)	95121
C4	CAPACITOR, MICA, DIPPED: 75 pF, 5%, 500V	1	CM05ED750J03	81349
C5	CAPACITOR, MICA, DIPPED: 2200 pF, 5%, 500V	1	CM06FD222J03	81349
C6	Same as C1			
C7	Same as C1			
C8	Same as C1			
C9	Same as C1			
C10	Same as C1			
C11	CAPACITOR, MICA, DIPPED: 110 pF, 5%, 500V	2	CM05ED111J03	81349
C12	Same as C11			
C13	CAPACITOR, MICA, DIPPED: 39 pF, 5%, 500V	4	CM05ED390J03	81349
C14	Same as C13			
C15	CAPACITOR, MYLAR, TUBULAR: 0.22 μF, 20%, 400V	2	B32234B6224M	25088
C16	Same as C15			
C17	Same as C13			
C18	Same as C13			
C19	CAPACITOR, MICA, DIPPED: 100 pF, 5%, 500V	1	CM05FD101J03	81349
C20	CAPACITOR, MICA, DIPPED: 10 pF, ±0.5 pF, 500V	3	CM05FD100D03	81349
C21	Same as C20			
C22	Same as C20			
CR1	DIODE	6	5082-2800	28480
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
L1	COIL, VARIABLE	2	7107-11	71279
L2	Same as L1			
L3	COIL, VARIABLE	1	7107-13	71279
Q1	TRANSISTOR	2	2N3478	80131
Q2	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	RCR07G101JS	81349

REF DESIG PREFIX A7

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R2	RESISTOR, FIXED, COMPOSITION: 24 kΩ, 5%, 1/4W	1	RCR07G243JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 9.1 kΩ, 5%, 1/4W	2	RCR07G912JS	81349
R4	Same as R3			
R5	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	RCR07G470JS	81349
R6	Same as R5			
R7	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	1	RCR07G182JS	81349
R8	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	3	RCR07G104JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 200 kΩ, 5%, 1/4W	1	RCR07G204JS	81349
R10	RESISTOR, FIXED, COMPOSITION: 2.2 MΩ, 5%, 1/4W	2	RCR07G225JS	81349
R11	Same as R10			
R12	RESISTOR, FIXED, COMPOSITION: 10 MΩ, 5%, 1/4W	1	RCR07G106JS	81349
R13	RESISTOR, VARIABLE, FILM: 50 kΩ, 30%, 1/2W	1	62PAR50K	73138
R14	Same as R8			
R15	RESISTOR, FIXED, COMPOSITION: 240 kΩ, 5%, 1/4W	1	RCR07G244JS	81349
R16	Same as R8			
R17	RESISTOR, FIXED, COMPOSITION: 1 MΩ, 5%, 1/4W	1	RCR07G105JS	81349

5.4.9 Type 8243 Sweep Generator

REF DESIG PREFIX A8

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μF, 10%, 20V	2	CS13BE106K	81349
C2	Same as C1			
C3	CAPACITOR, CERAMIC, DISC: 0.1 μF, 20%, 100V	2	8131-100-651-104M	72982
C4	Same as C3			
C5	CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 μF, 10%, 35V	1	CS13BF105K	81349
Q1	TRANSISTOR	1	2N2646	80131
Q2	TRANSISTOR	1	2N3251	80131
R1	RESISTOR, FIXED, COMPOSITION: 360 Ω, 5%, 1/4W	1	RCR07G361JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 20 kΩ, 5%, 1/4W	1	RCR07G203JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 24 kΩ, 5%, 1/4W	1	RCR07G243JS	81349
R5	RESISTOR, VARIABLE, FILM: 50 kΩ, 30%, 1/2W	2	62PAR50K	73138
R6	RESISTOR, FIXED, COMPOSITION: 75 kΩ, 5%, 1/4W	1	RCR07G753JS	81349
R7 *	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	1	RCR07G392JS	81349
R8	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	7	RCR07G104JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 91 kΩ, 5%, 1/4W	1	RCR07G913JS	81349
R10	RESISTOR, FIXED, COMPOSITION: 120 kΩ, 5%, 1/4W	1	RCR07G124JS	81349
R11	RESISTOR, VARIABLE, FILM: 100 kΩ, 30%, 1/2W	2	62PAR100K	73138
R12	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	2	RCR07G473JS	81349
R13	Same as R8			
R14	Same as R5			
R15	Same as R8			
R16	Same as R12			
R17	RESISTOR, FIXED, COMPOSITION: 62 kΩ, 5%, 1/4W	1	RCR07G623JS	81349
R18	Same as R11			
R19	Same as R8			
R20	Same as R8			
R21	Same as R8			
U1	INTEGRATED CIRCUIT	5	U5B7741393	07263
U2	Same as U1			
U3	Same as U1			
U4	Same as U1			
U5	Same as U1			

* Nominal value. Final value to be factory selected.

REF DESIG PREFIX A8

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
VR1	VOLTAGE REGULATOR	1	1N758A	80131

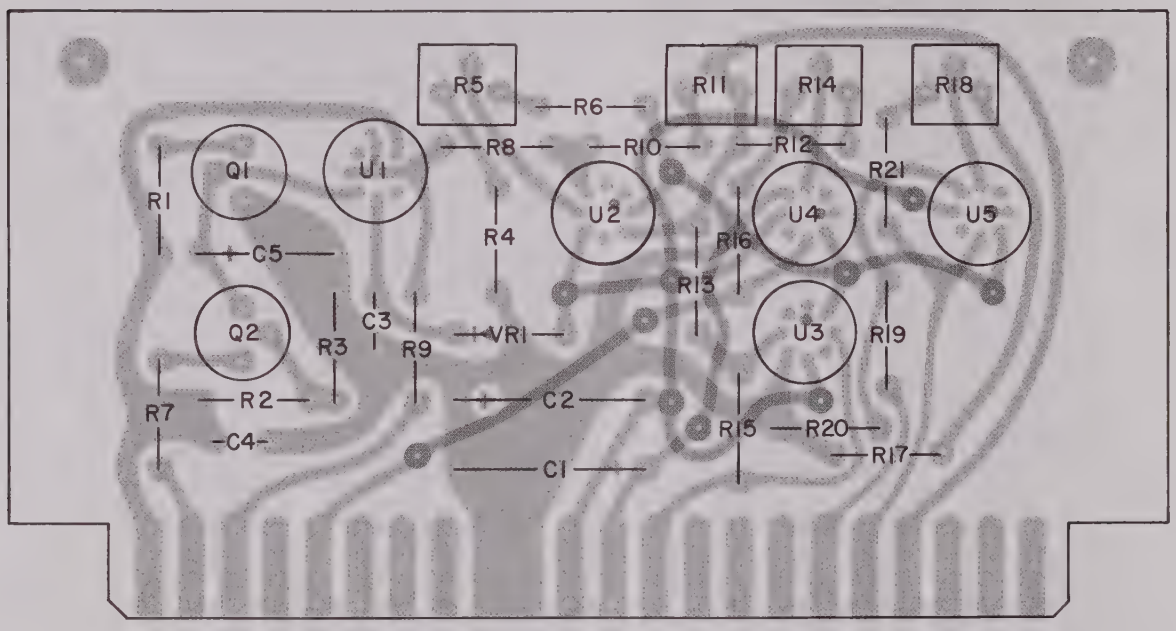


Figure 5-16. Type 8243 Sweep Generator (A8), Location of Components

Figure 5-17

5.4.10 Type 79750 Bandpass Filter

REF DESIG PREFIX A9

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	FILTER BOARD	1	16029	14632
J1	CONNECTOR, RECEPTACLE, MB SERIES	2	46025	74868
J2	Same as J1			
MP1	COVER	1	16032-1	14632

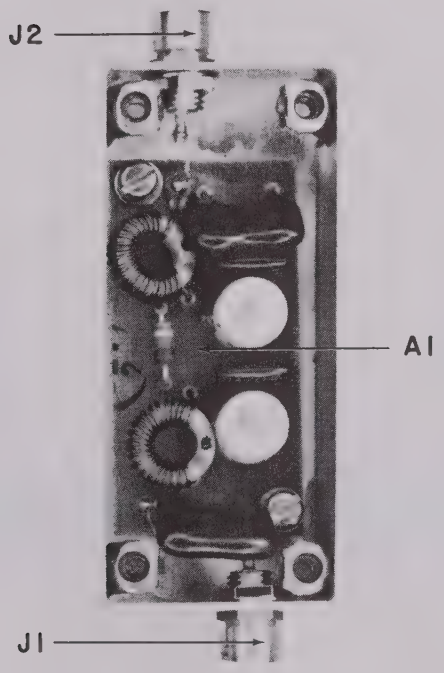


Figure 5-17. Type 79750 Bandpass Filter (A9), Location of Components

5.4.10.1 Part 16029 Filter Board

REF DESIG PREFIX A9A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, MICA, DIPPED: 2200 pF, 5%, 500V	2	CM06FD222J03	81349
C2	CAPACITOR, VARIABLE, CERAMIC: 2.5-11 pF, 350V	2	538-011B2.5-11	72982
C3	CAPACITOR, MICA, DIPPED: 27 pF, 5%, 500V	2	CM05ED270J03	81349
C4	Same as C2			
C5	Same as C3			
C6	CAPACITOR, COMPOSITION, TUBULAR: .12 pF, 10%, 500V	1	QC(.12pF,K)	95121
C7	Same as C1			
L1	COIL, FIXED	2	20681-60	14632
L2	Same as L1			

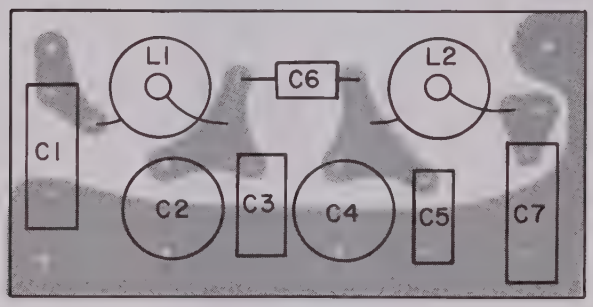
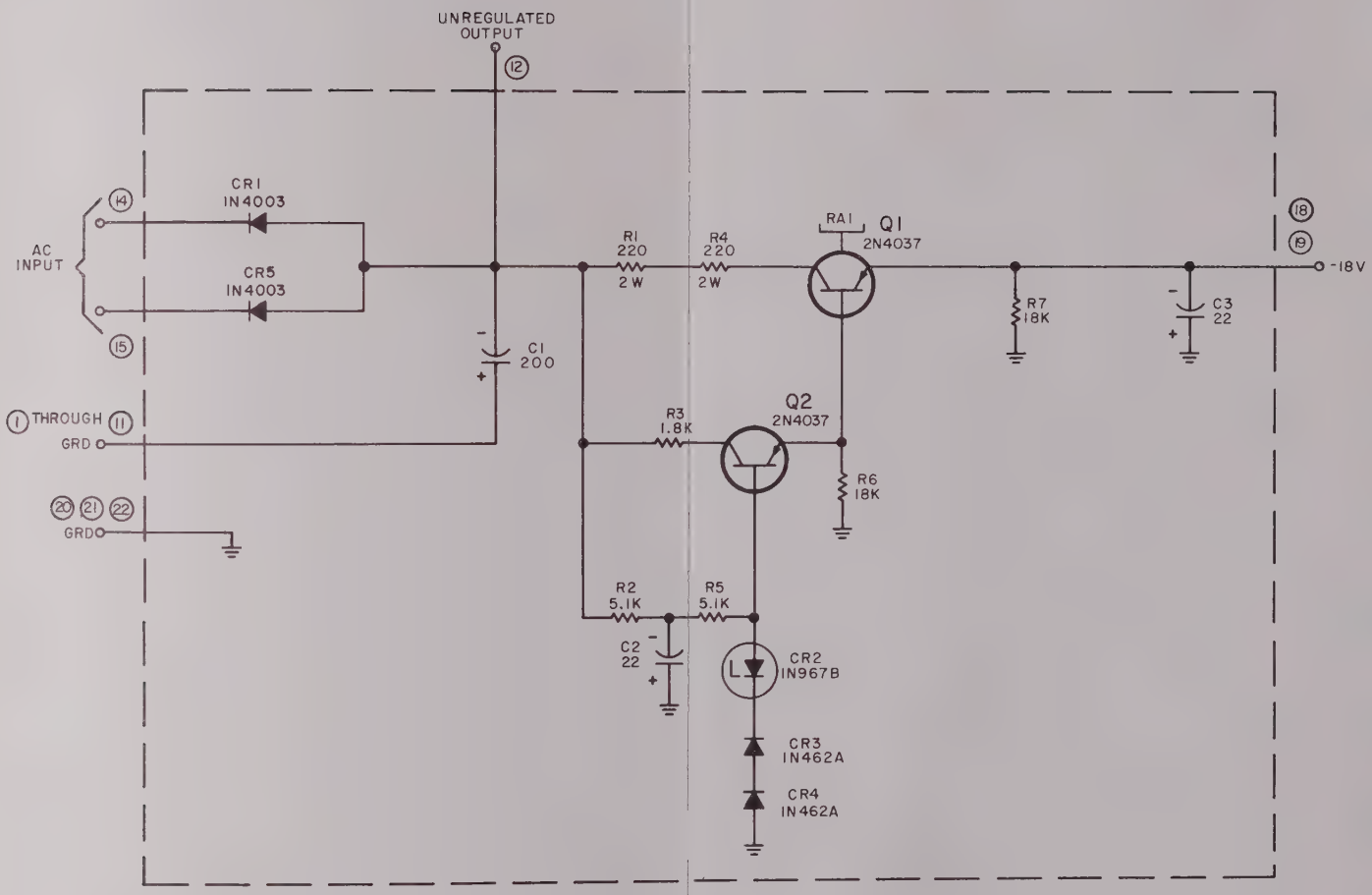


Figure 5-18. Part 16029 Filter Board (A9A1), Location of Components

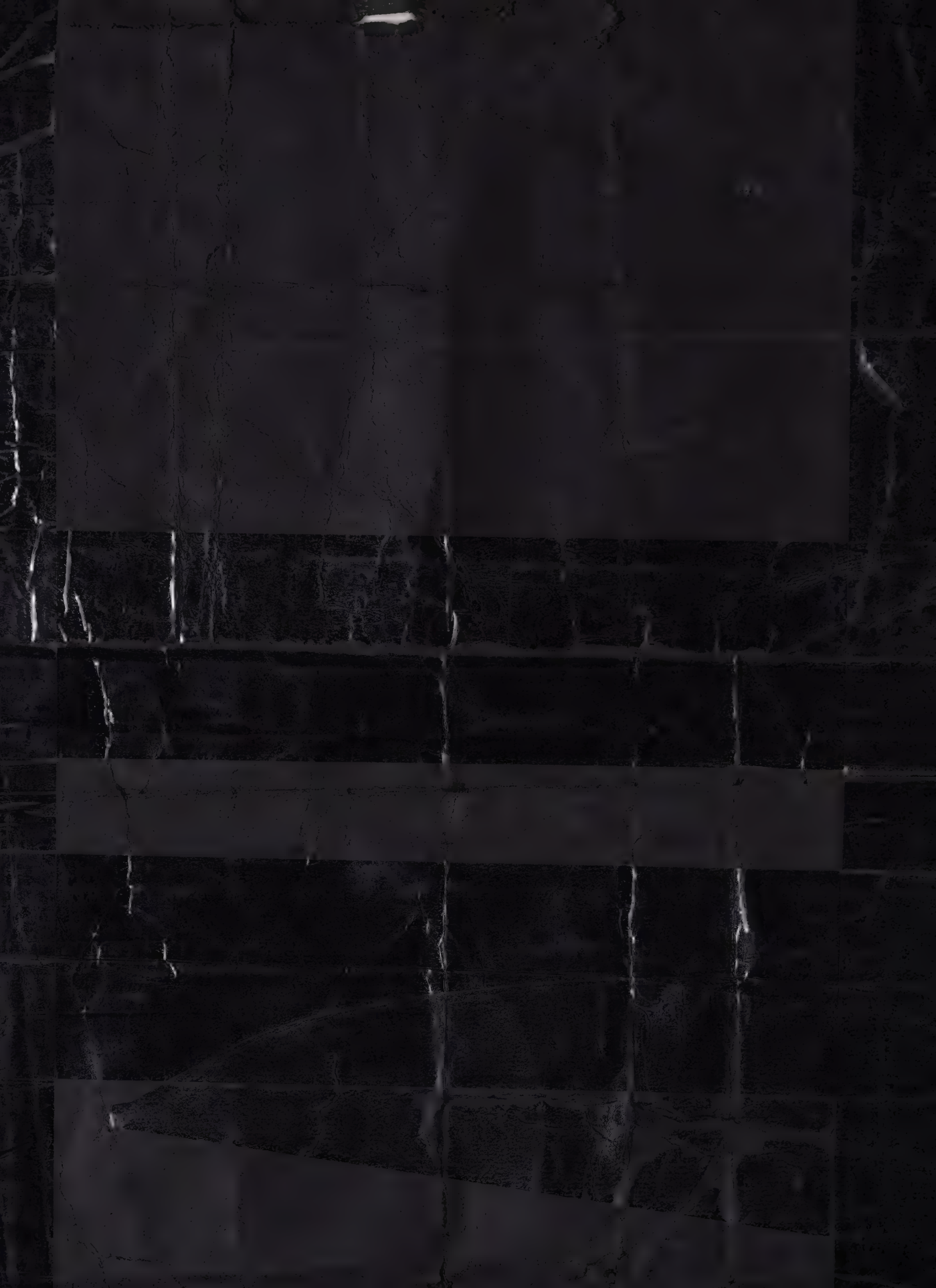
SECTION VI
SCHEMATIC DIAGRAMS

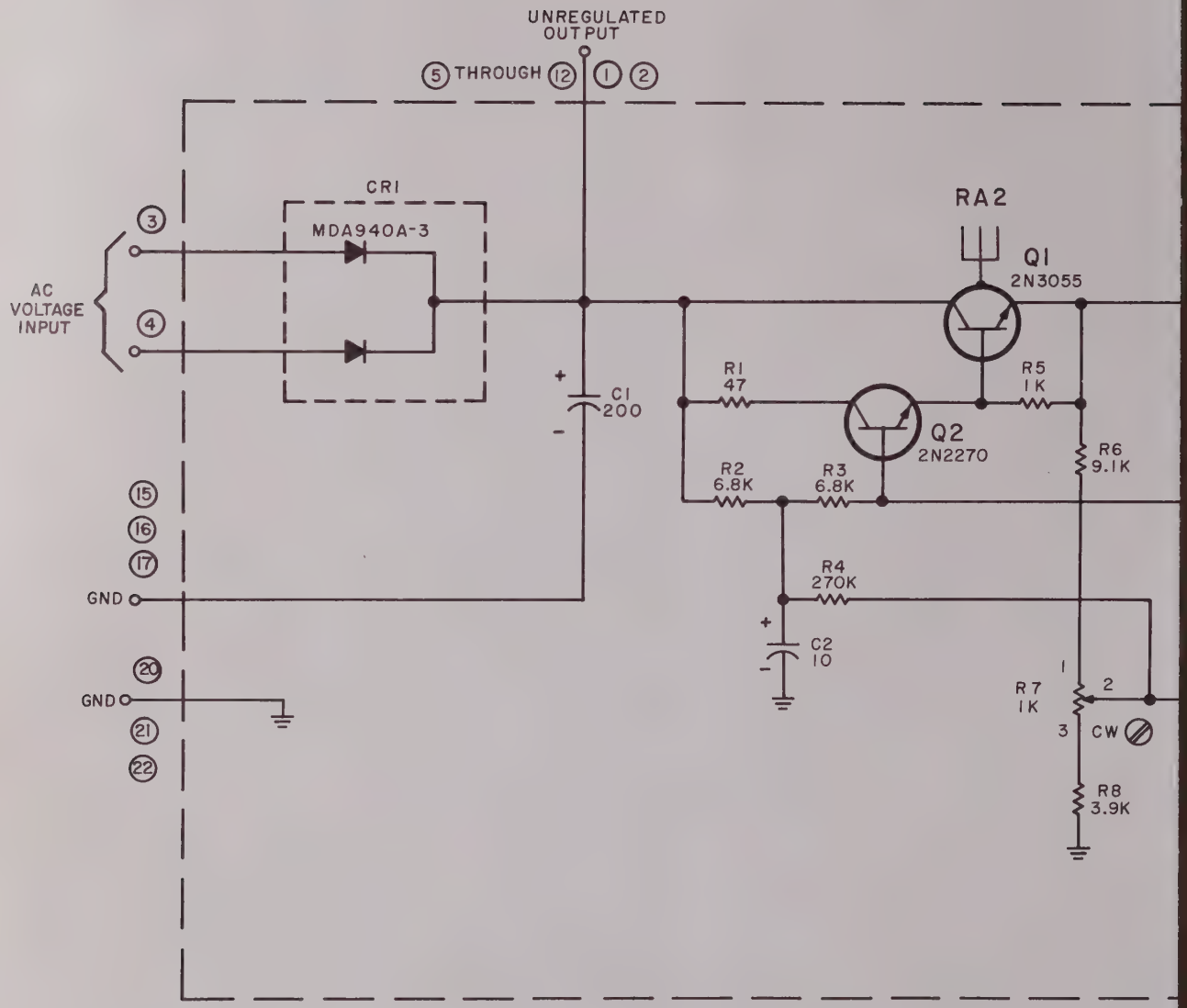


NOTES:

1) UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4 W.
   b) CAPACITANCE IS MEASURED IN μF.

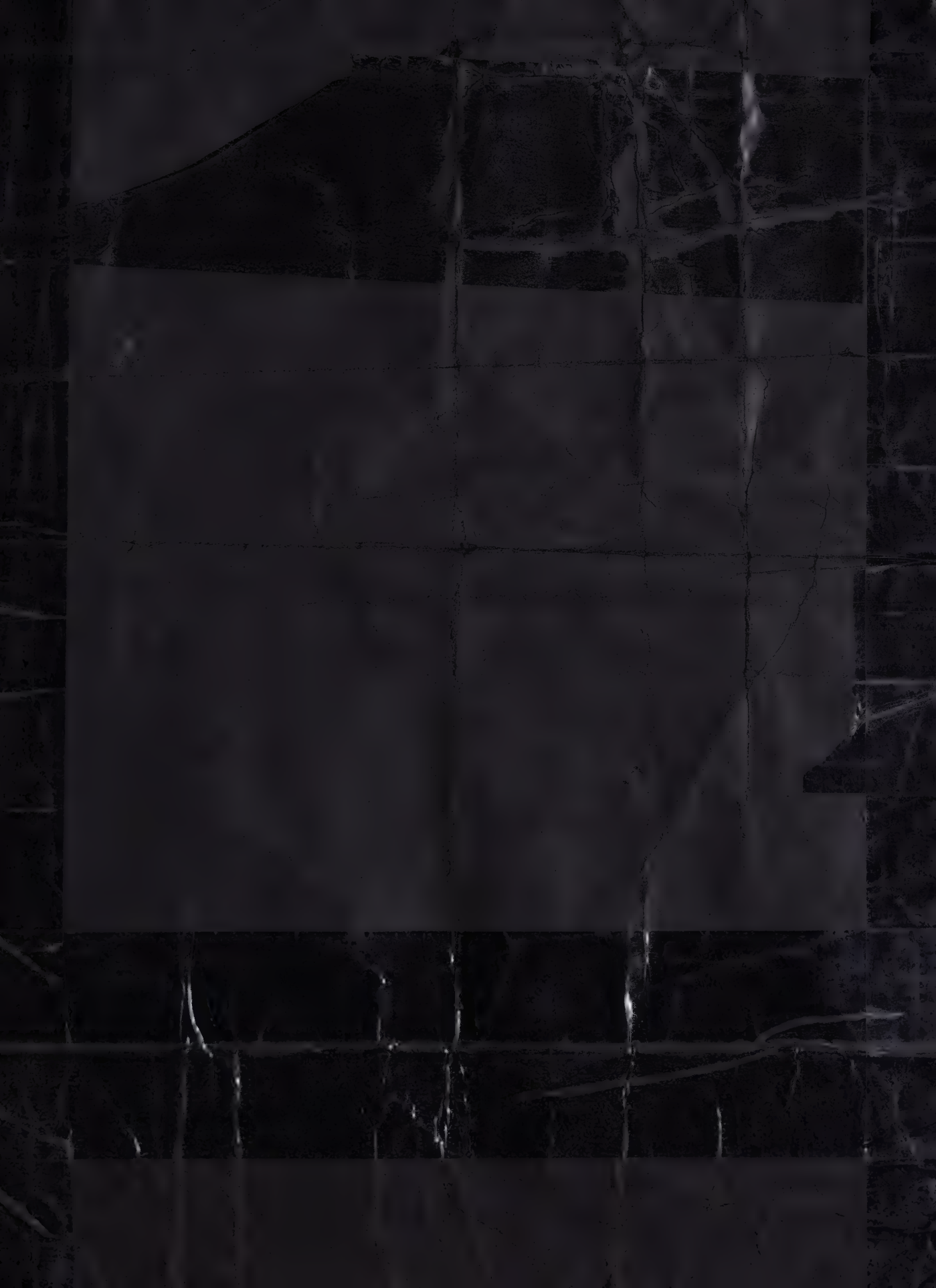
Figure 6-1. Type 76168 -18V Regulated Power Supply (A1), Schematic Diagram

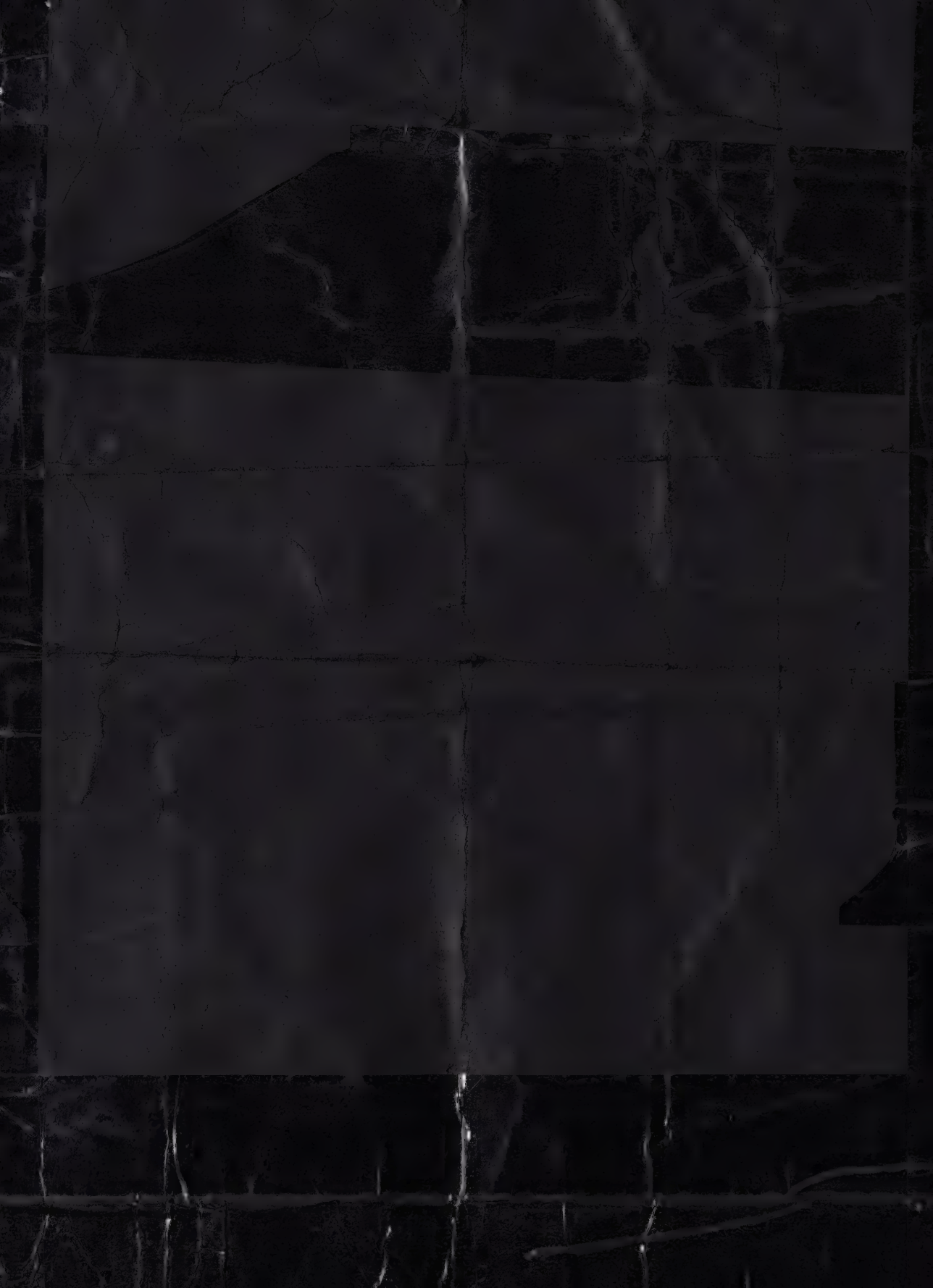




NOTES:

1) UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN μF.
2) ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.





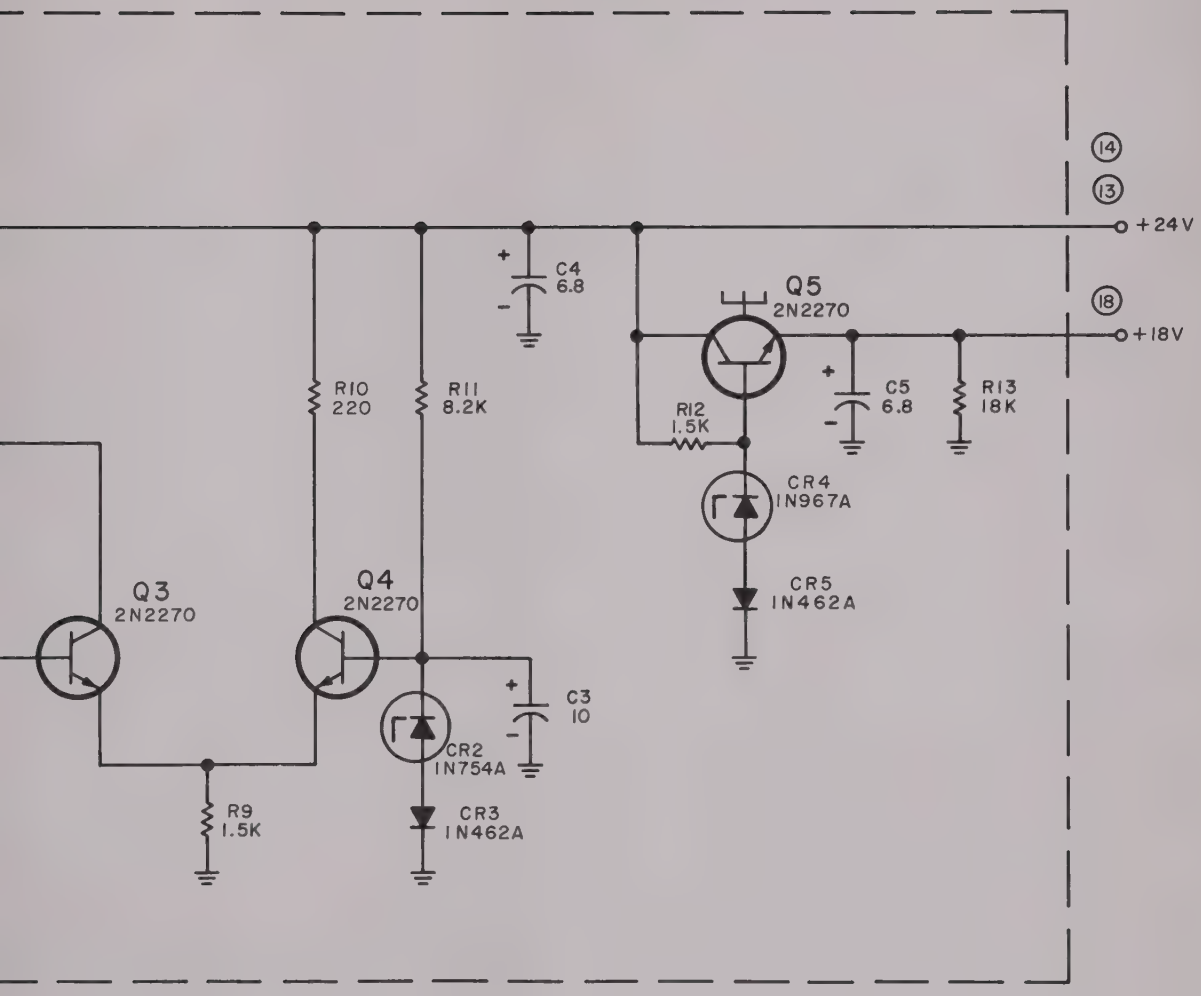
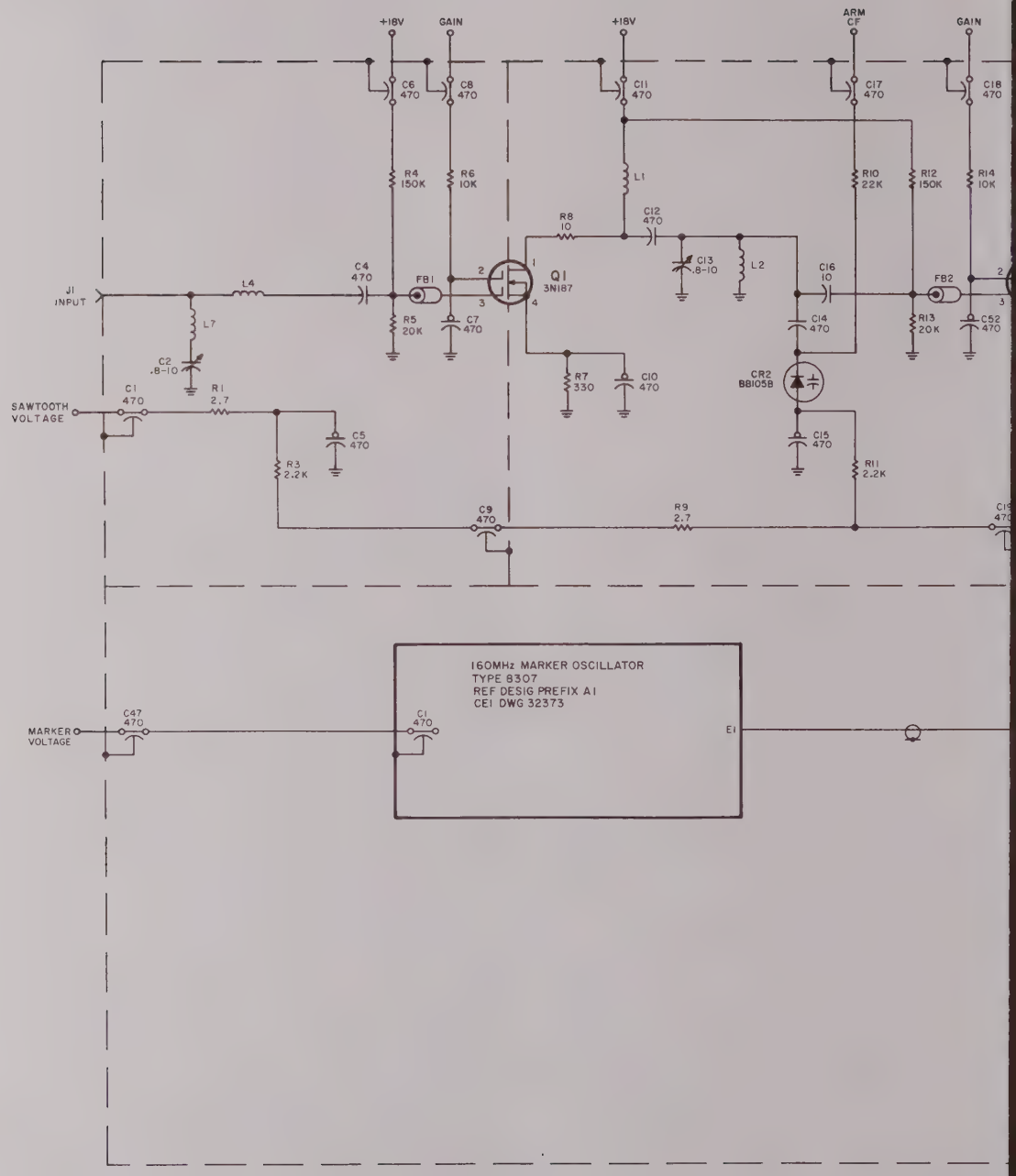
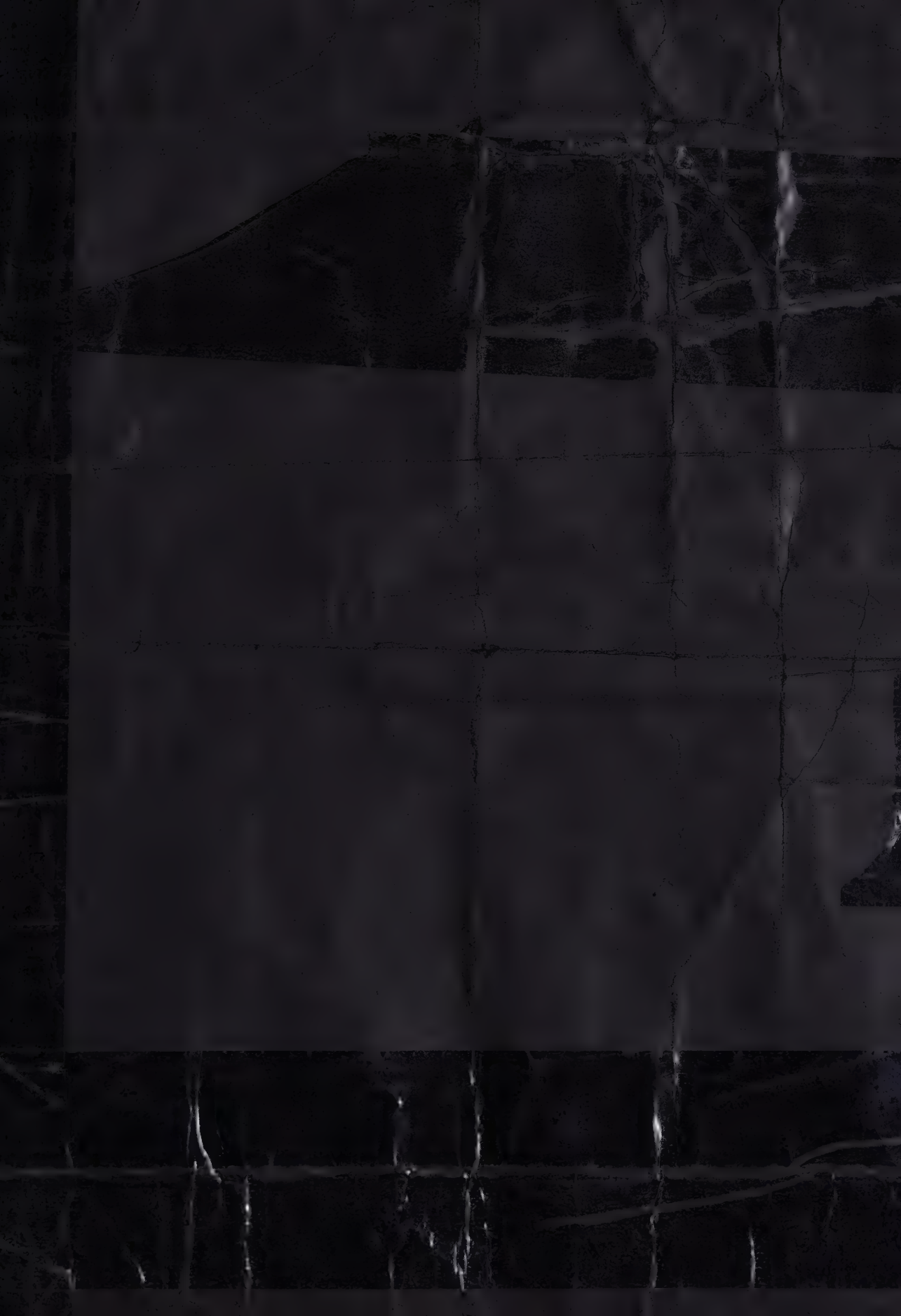


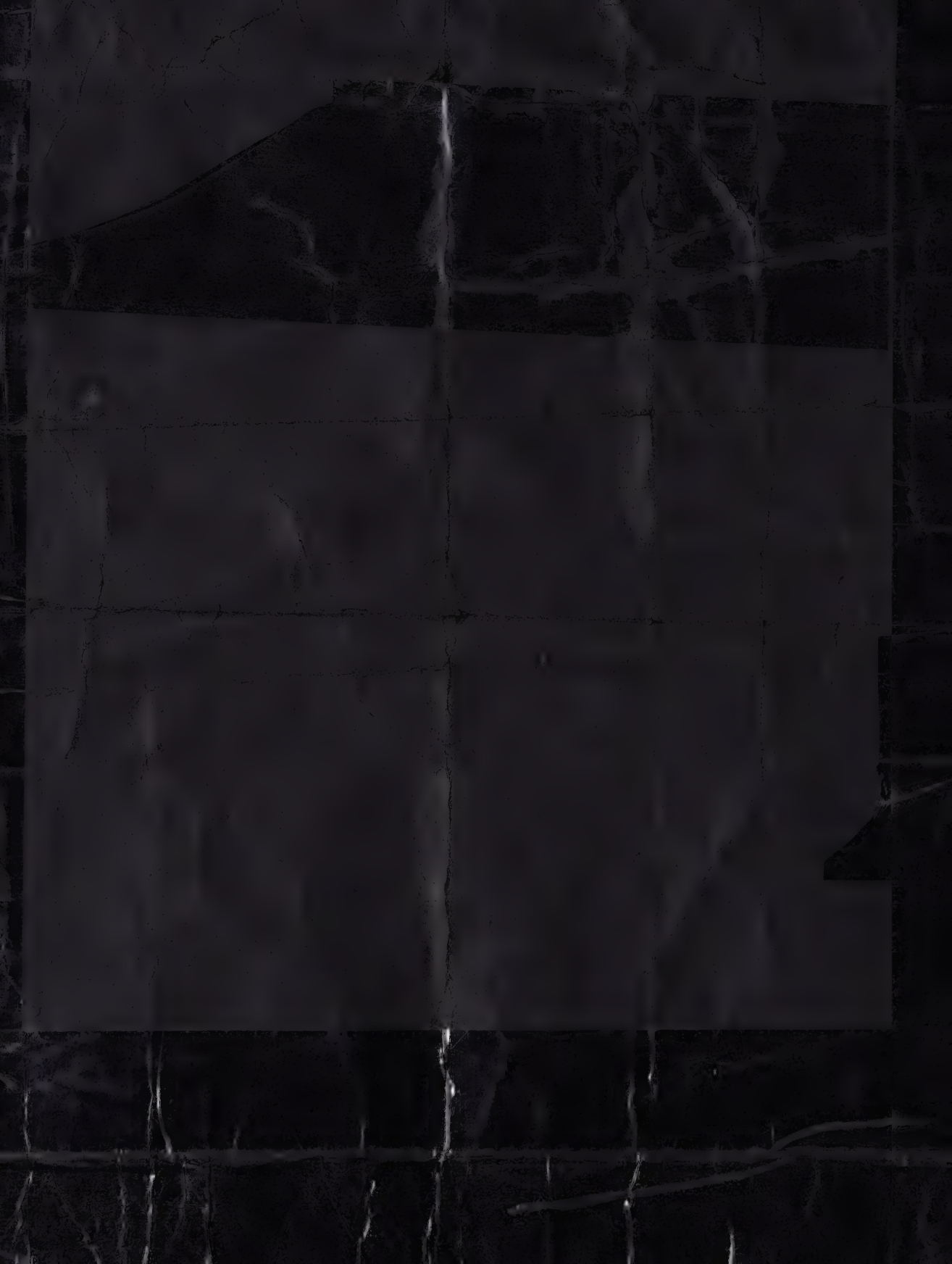
Figure 6-2. Type 76166 +18V & +24V Regulated Power Supply (A2), Schematic Diagram

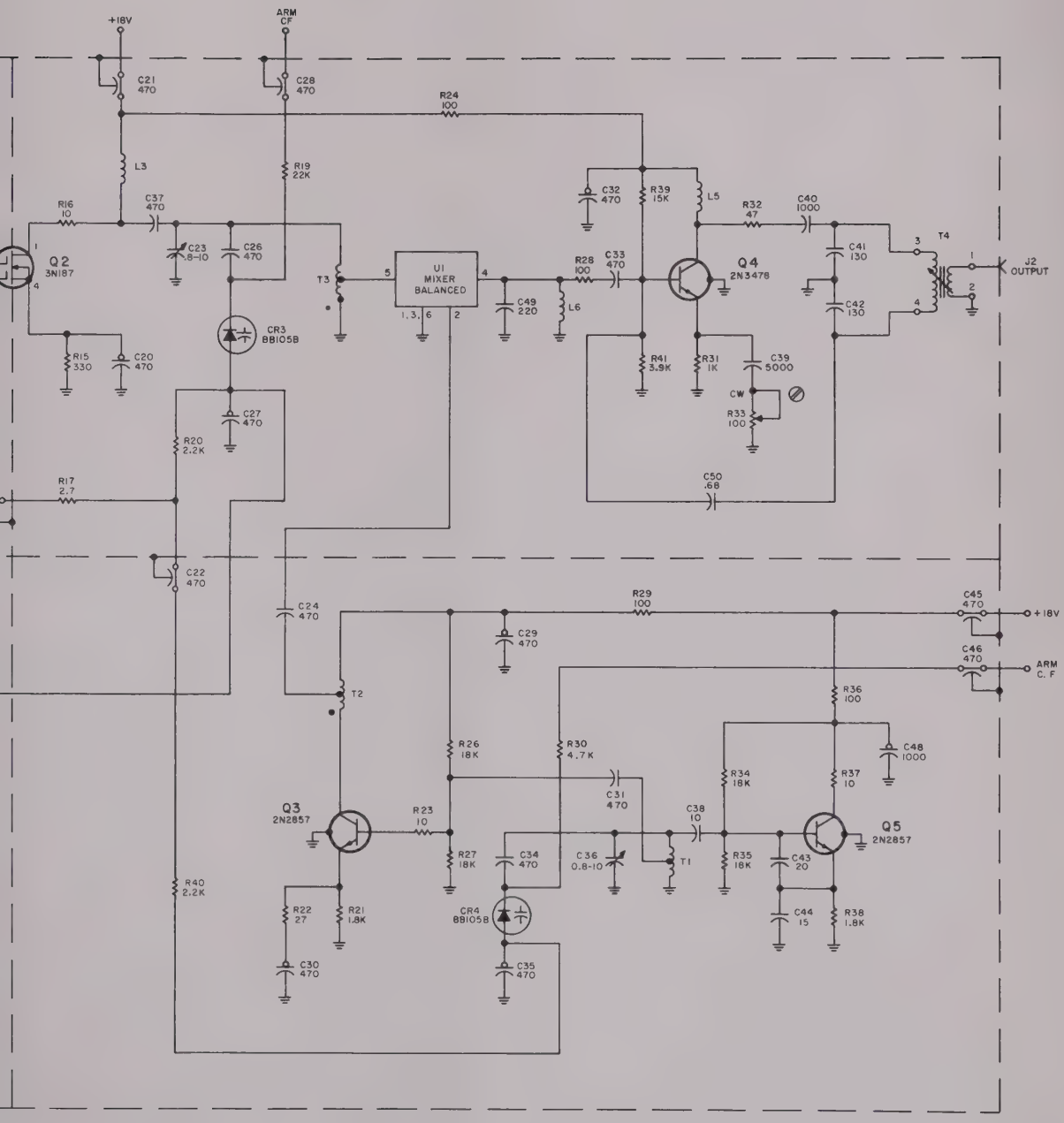


NOTES

1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pF.
2. THE FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   a) CW INDICATES CLOCKWISE ROTATION.
   b) ⊘ INDICATES SCREWDRIVER ADJUSTMENT.

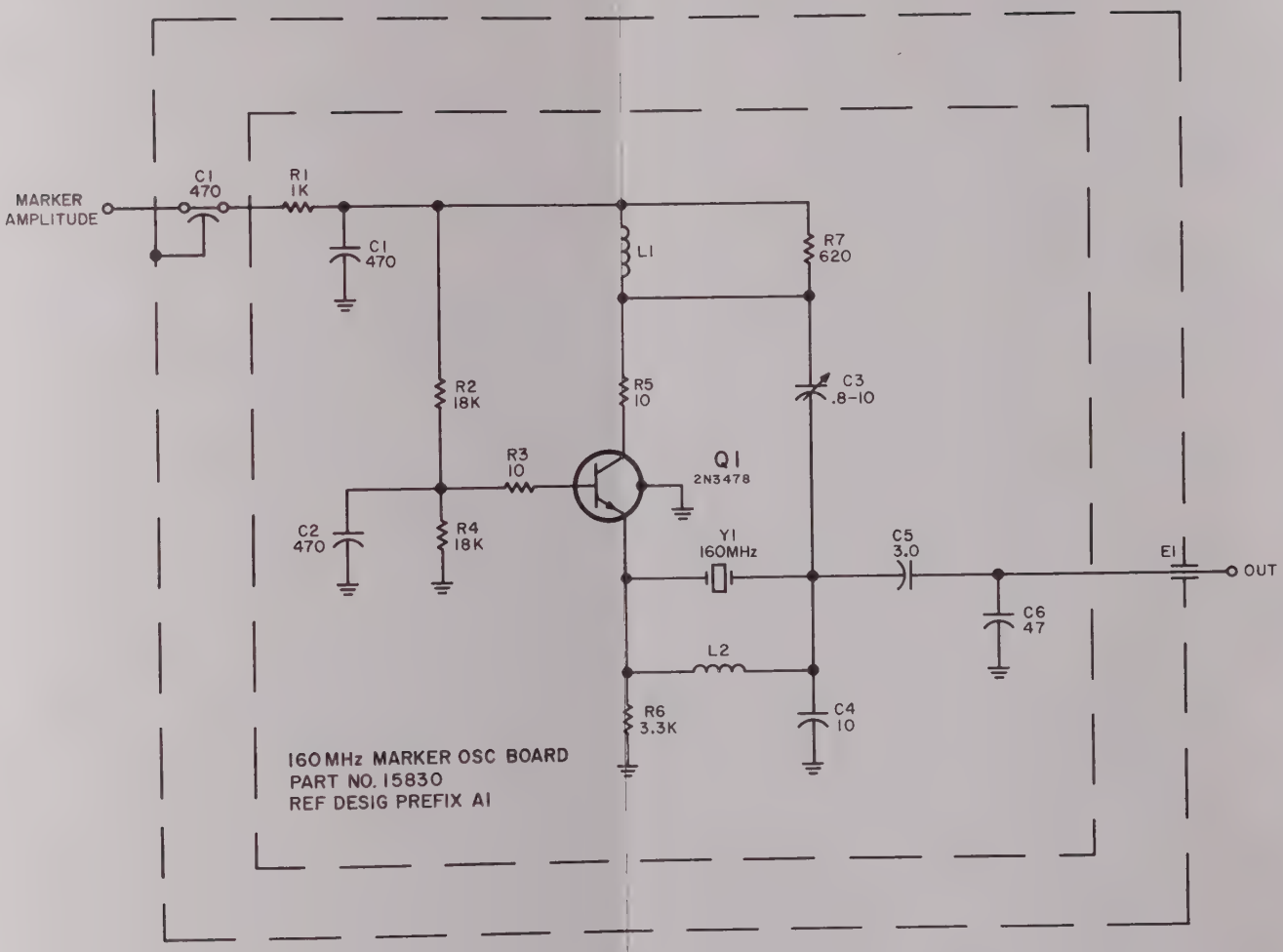






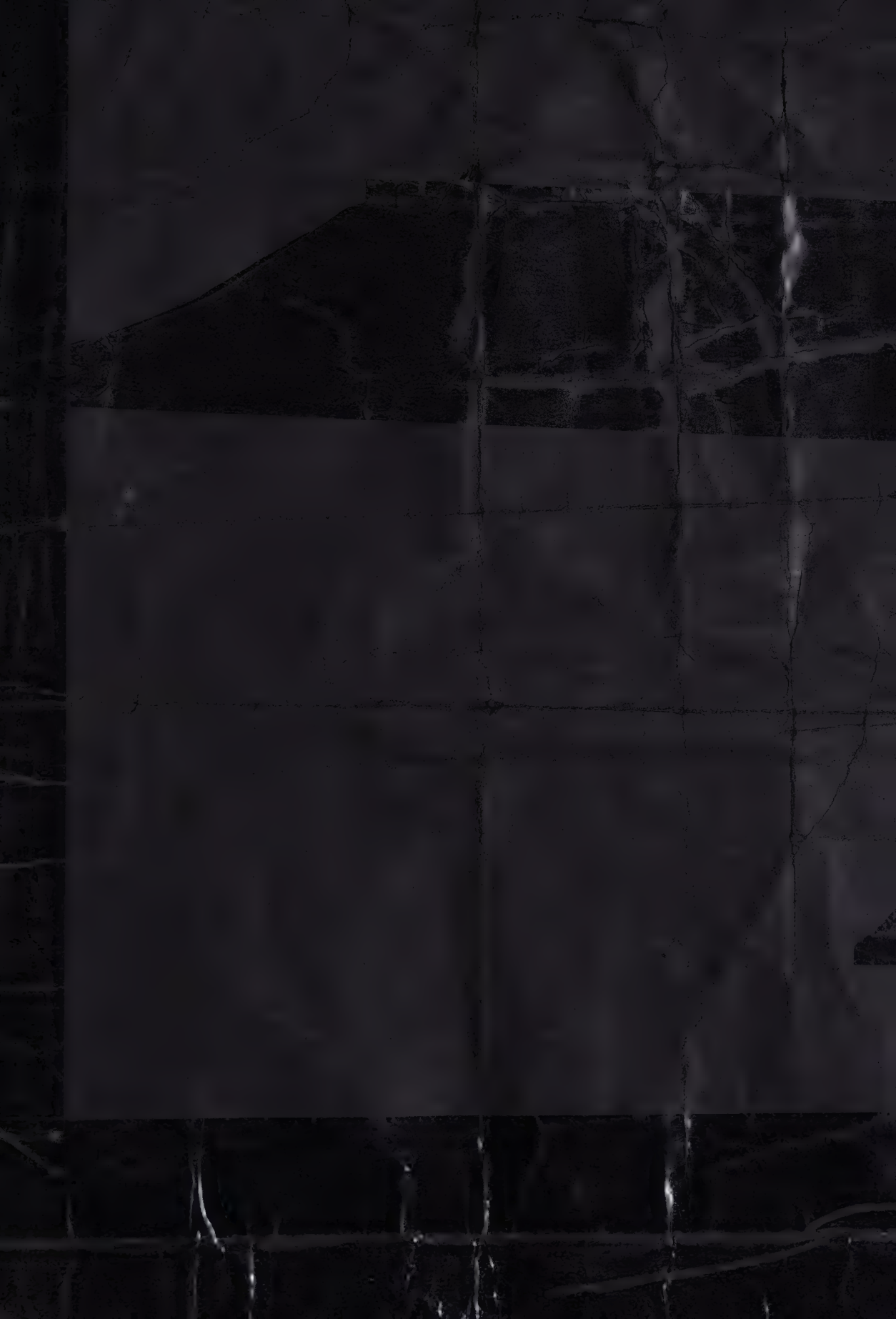
Change 1
12/3/75

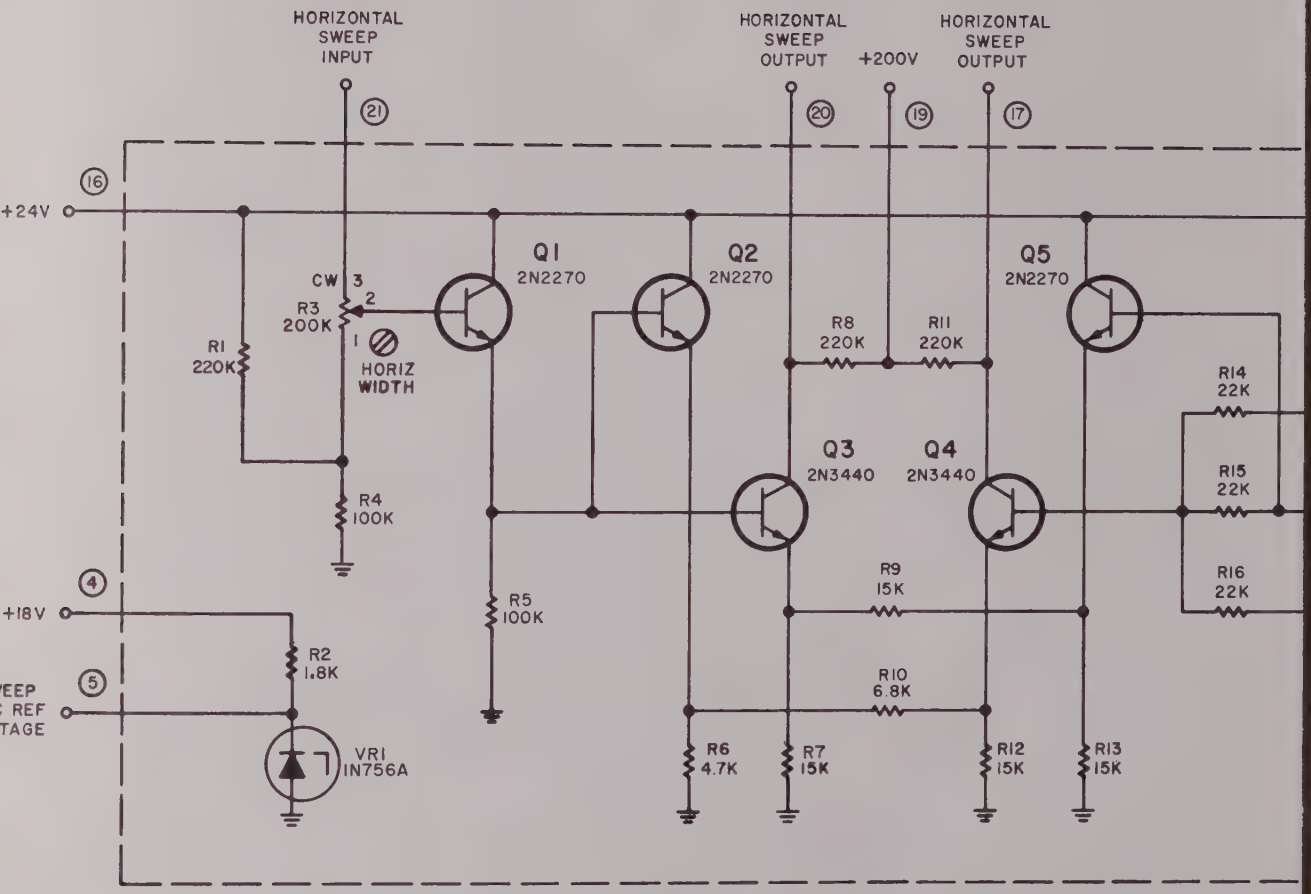
Figure 6-3. Type 71290 160-MHz Tuner (A3), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pF.

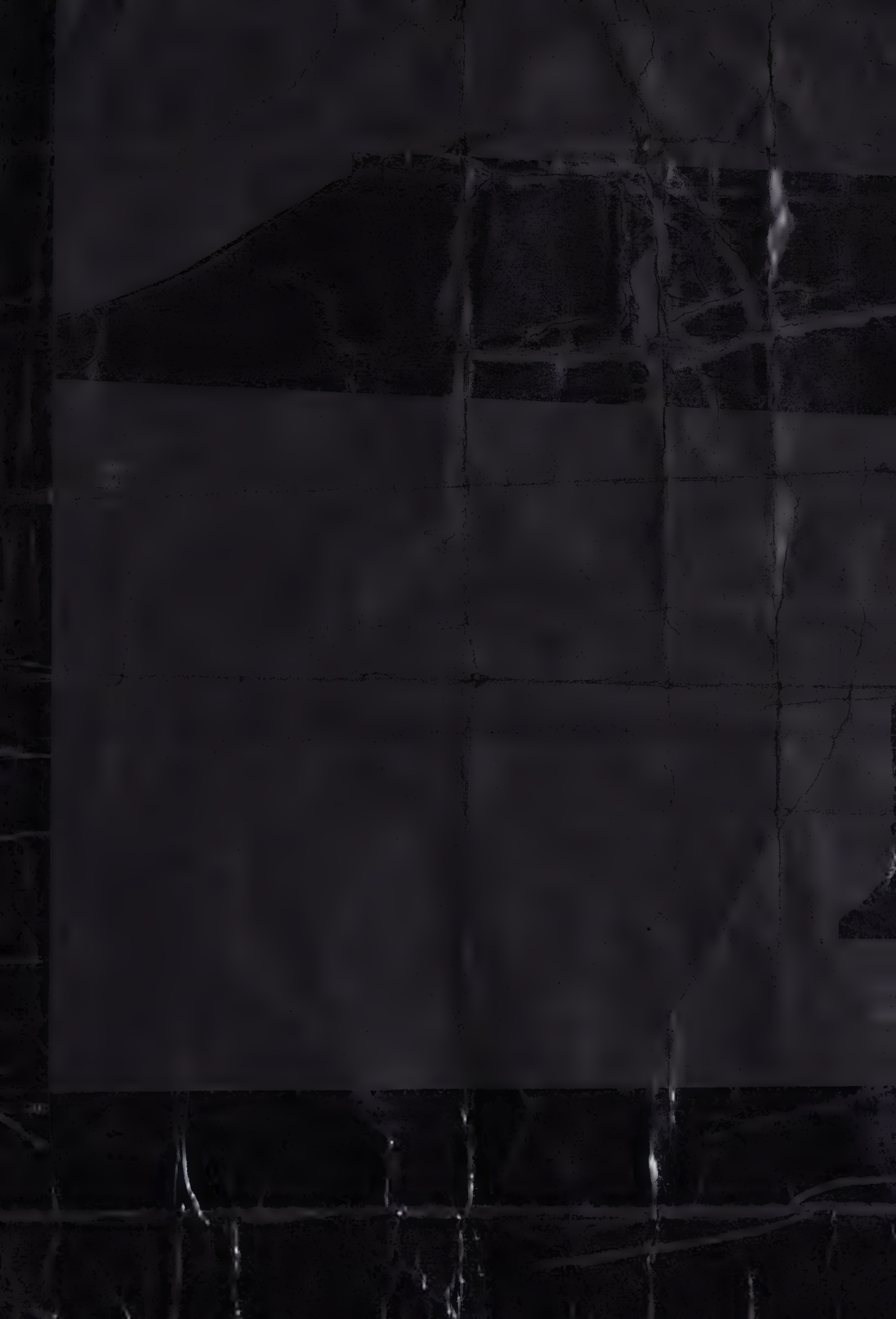
Figure 6-4. Type 8307 160-MHz Marker Oscillator (A3A1), Schematic Diagram

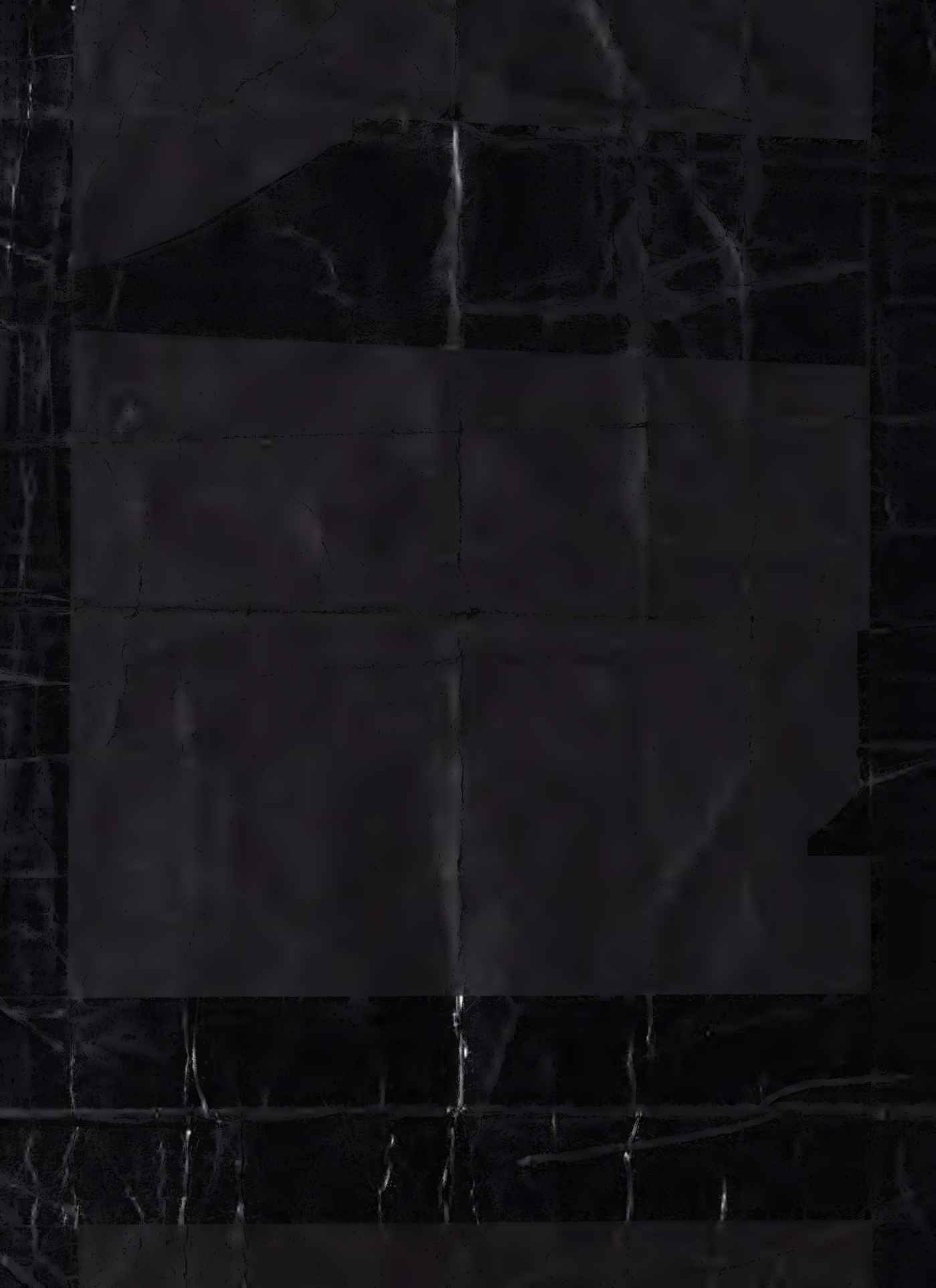


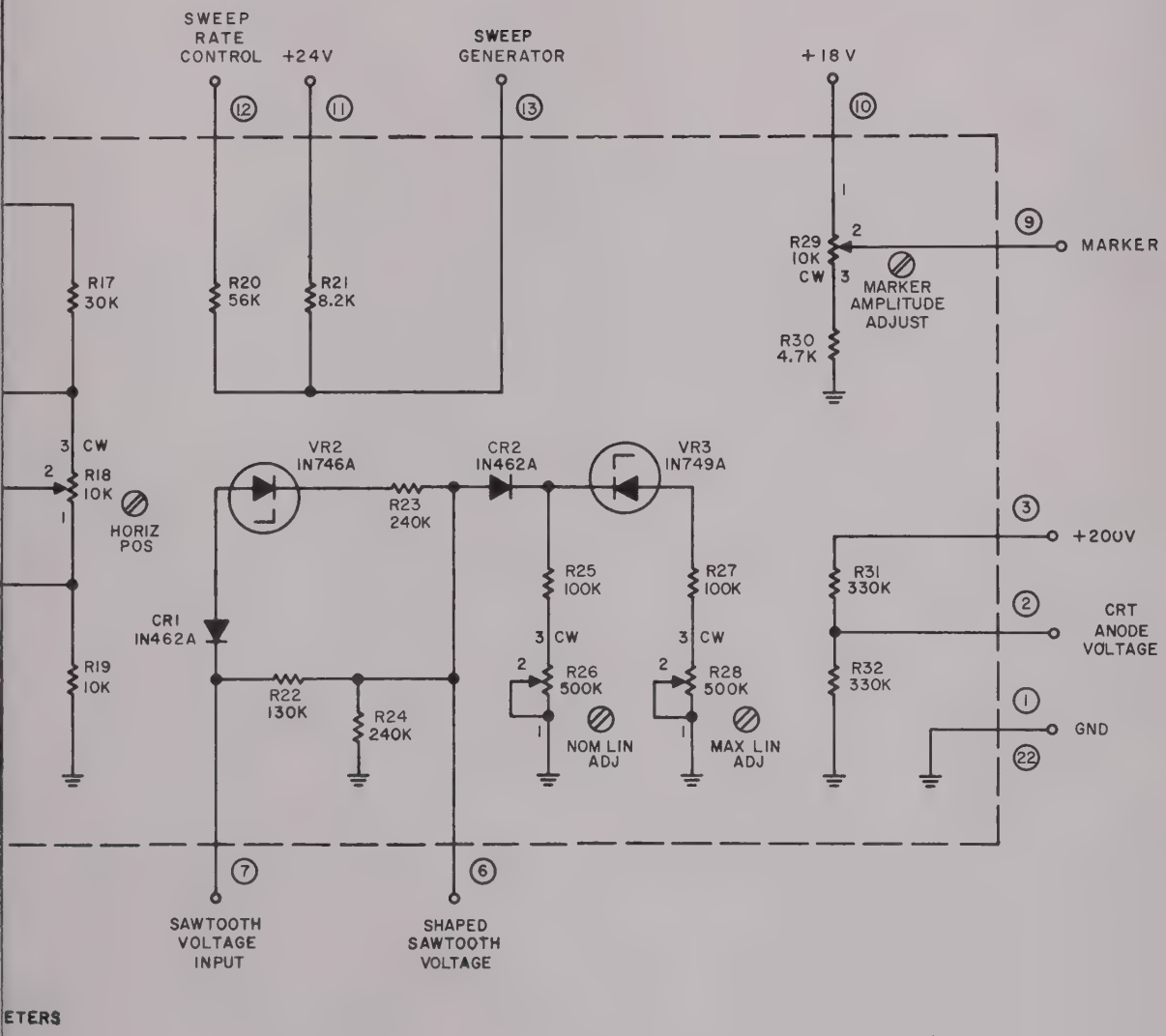


NOTES:

1. RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS
3. FOLLOWING NOTATIONS ARE USED ON POTENTIOM
   a) CW INDICATES CLOCKWISE ROTATION
   b) ⊘ INDICATES SCREWDRIVER ADJUSTMENT

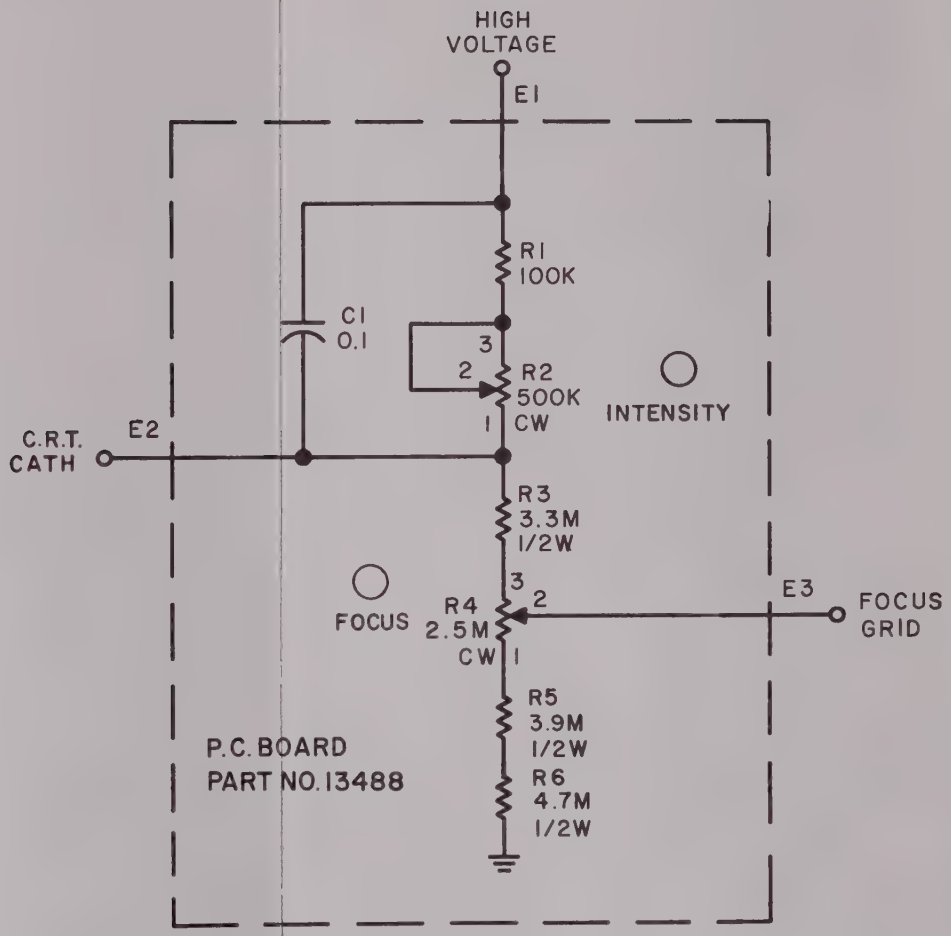






ETERS

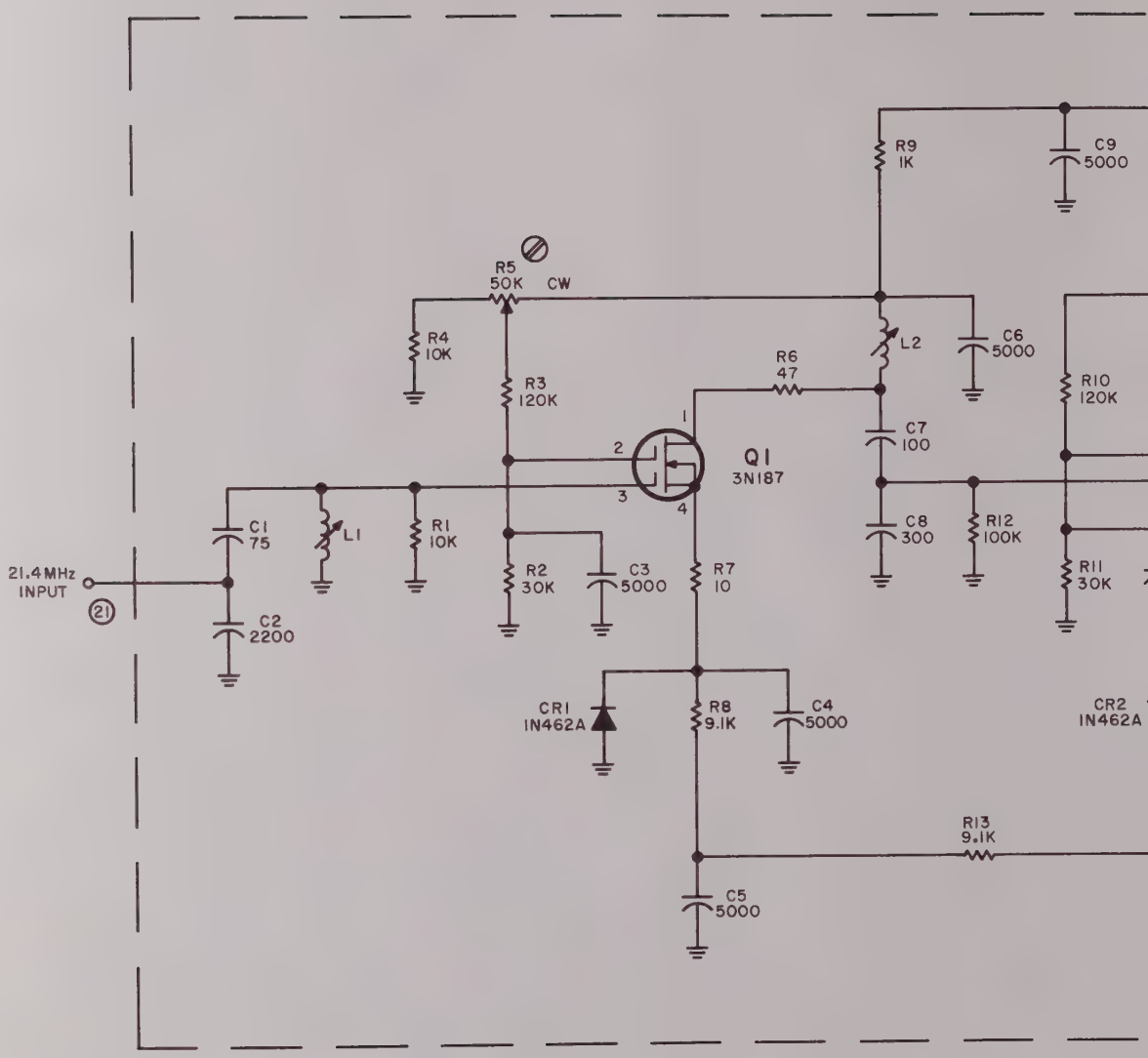
Figure 6-5. Type 8241 Horizontal Amplifier (A4), Schematic Diagram



NOTES:

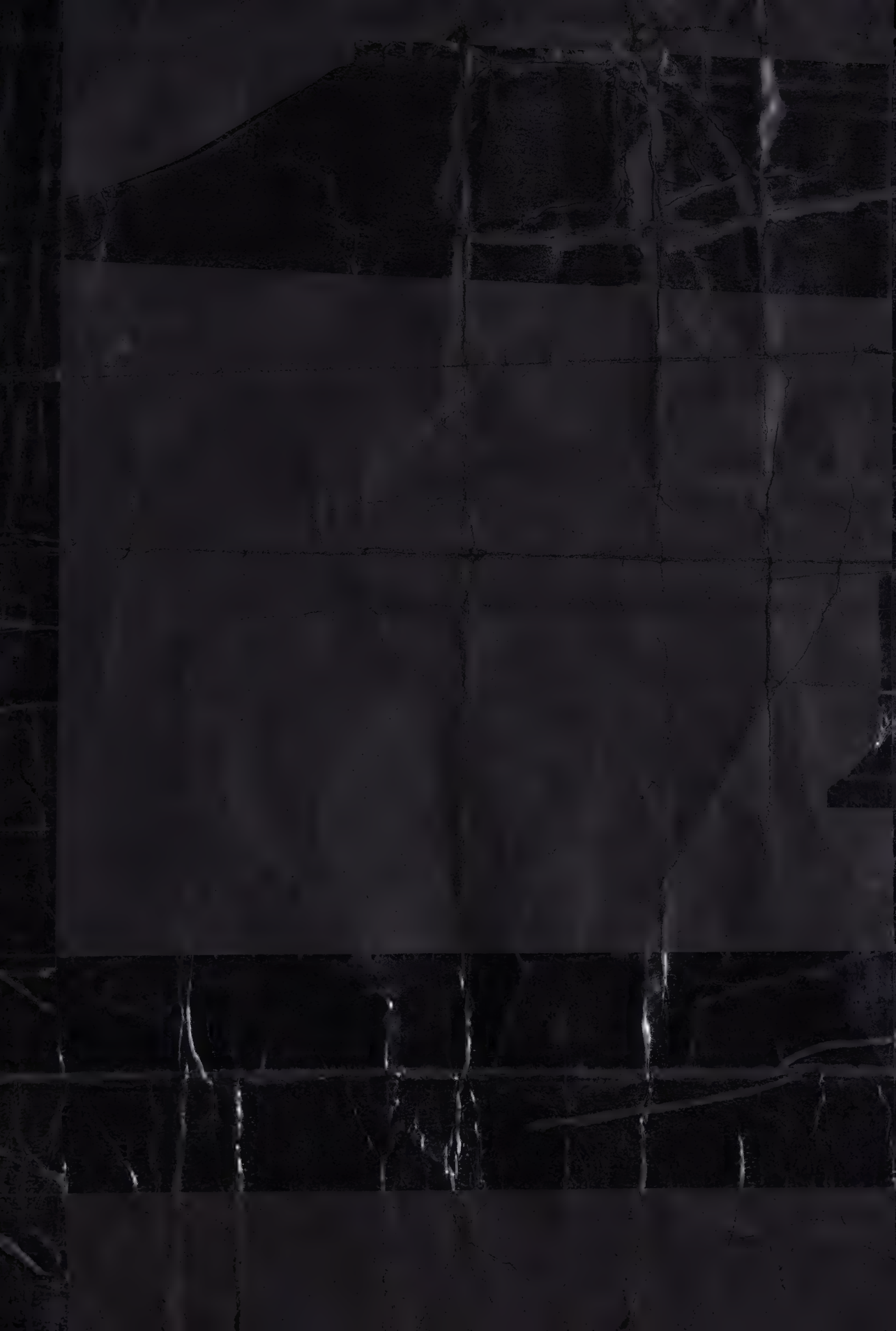
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, 5%, 1/4 W
   b) CAPACITANCE IS MEASURED IN μF
2. THE FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   a) CW INDICATES CLOCKWISE ROTATION OF CONTROL KNOB
   b) ◯ INDICATES FRONT PANEL CONTROL

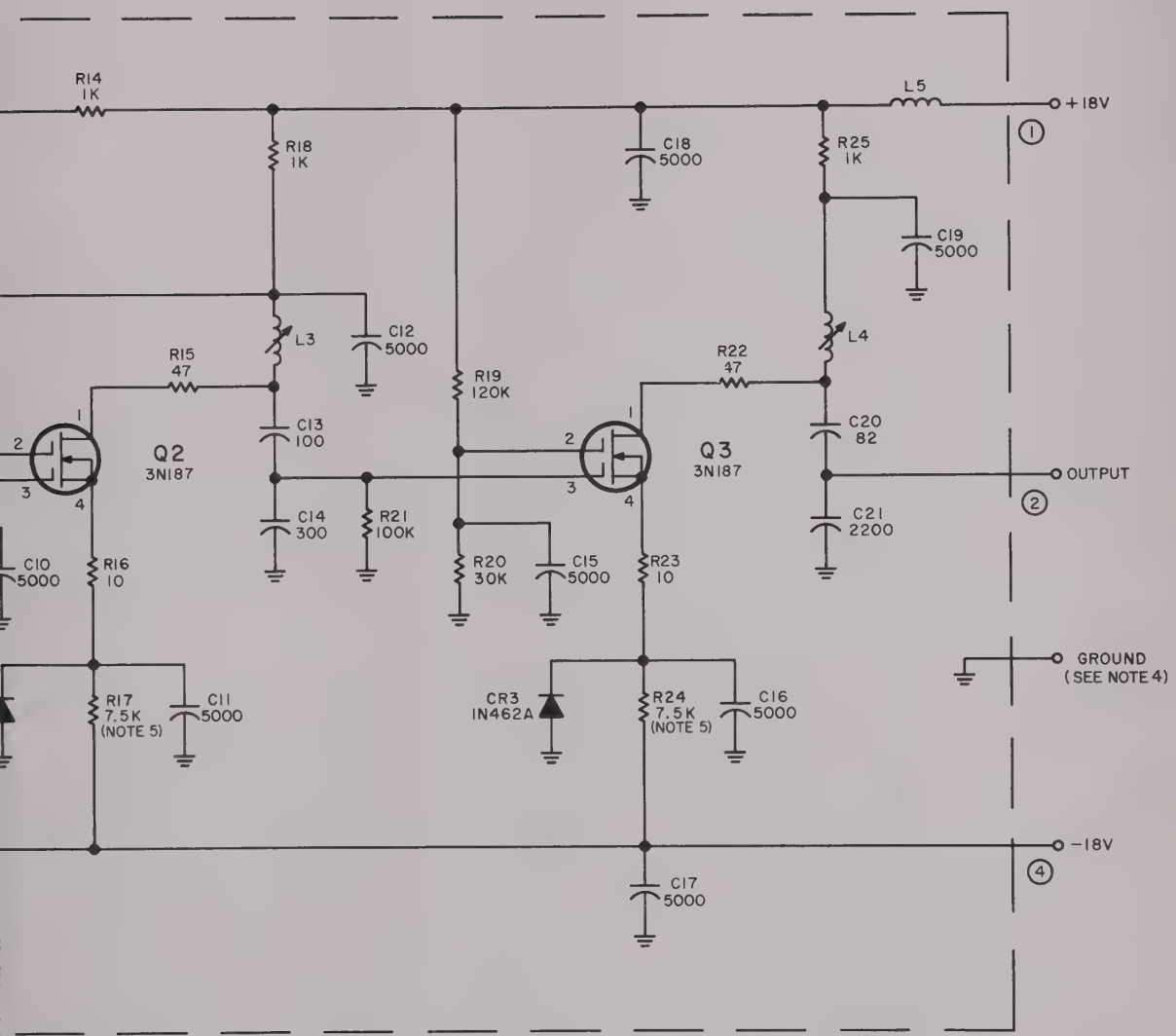
Figure 6-6. Part 13488 Focus and Intensity Board (A5), Schematic Diagram



NOTES:

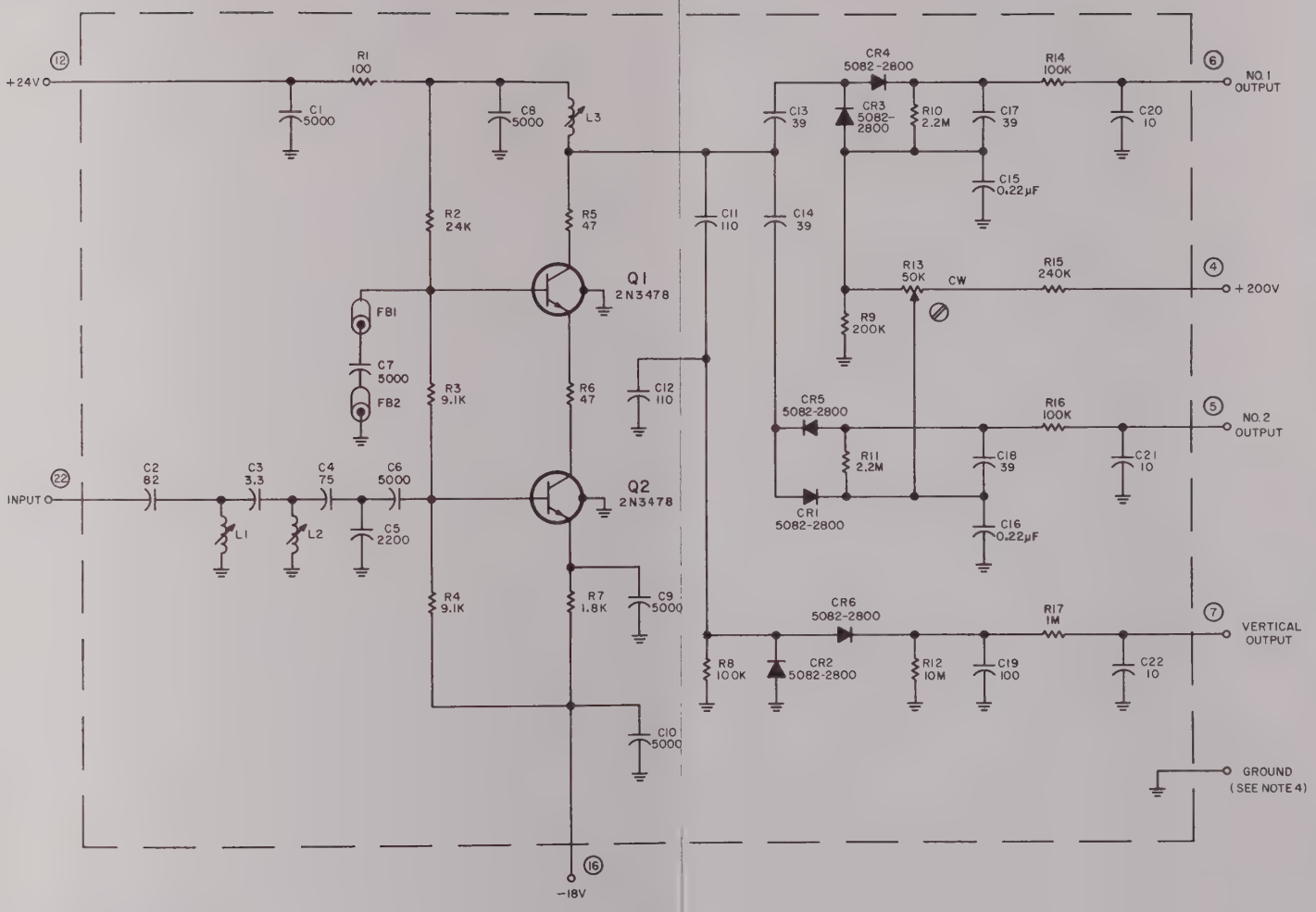
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. THE FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   a) CW INDICATES CLOCKWISE ROTATION.
   b) ⊘ INDICATES SCREWDRIVER ADJUSTMENT.
4. GROUND PINS FOR P.C. BOARD ARE AS FOLLOWS:
   3, 7, 8, 9, 14, 15 & 22.
5. NOMINAL VALUE; FINAL VALUE FACTORY SELECTED.





Change 1
12/3/75

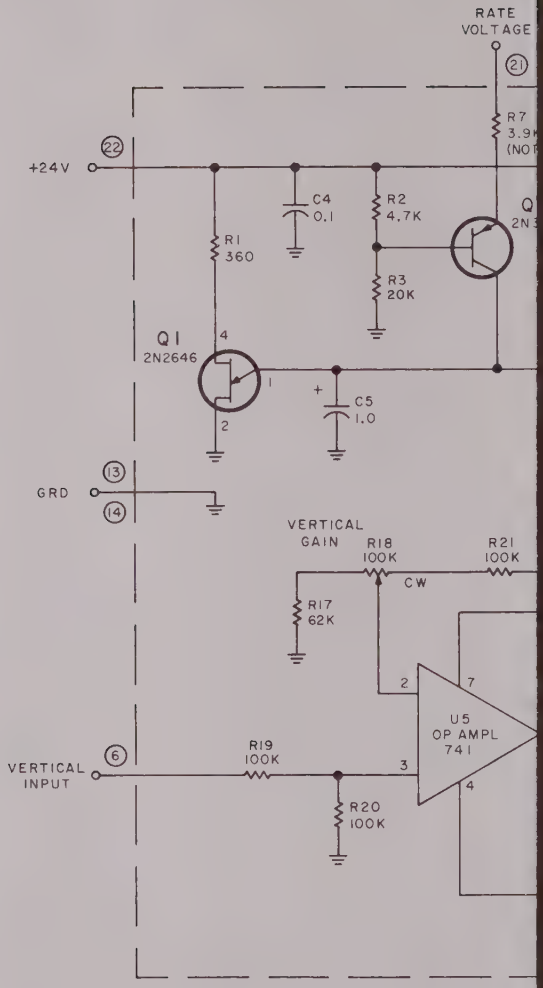
Figure 6-7. Type 8026 IF Amplifier (A6), Schematic Diagram



NOTES.
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. THE FOLLOWING SYMBOLS ARE USED ON POTENTIOMETERS:
   a) CW INDICATES CLOCKWISE ROTATION.
   b) ⊘ INDICATES SCREWDRIVER ADJUSTMENT.
4. GROUND PINS FOR P.C. BOARD ARE AS FOLLOWS:
   1,2,8 THRU 11, 13, 14, 15, 19, 20 & 21.

Change 1
12/3/75

Figure 6-8. Type 8138 Output Amplifier (A7), Schematic Diagram



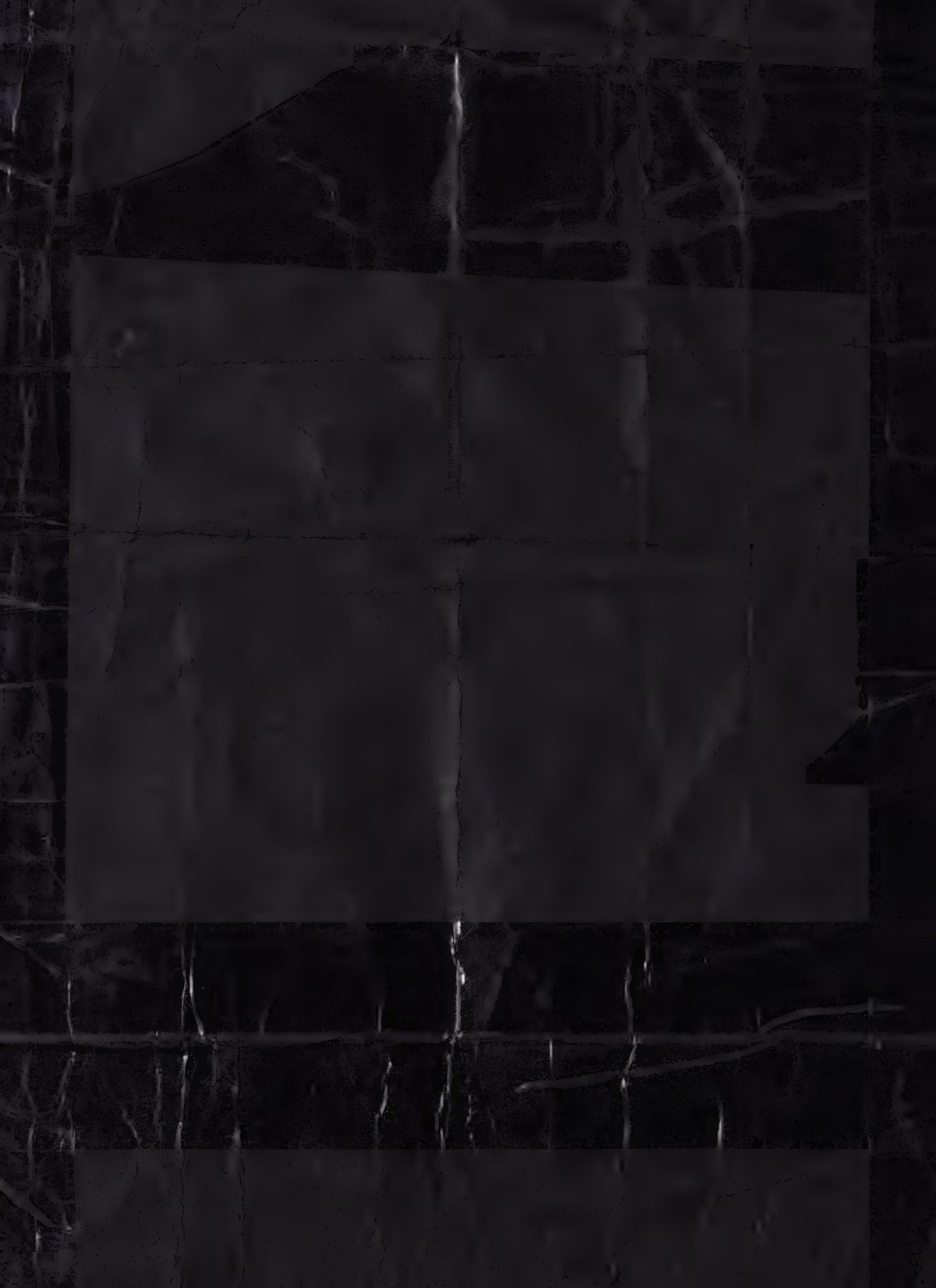
NOTES

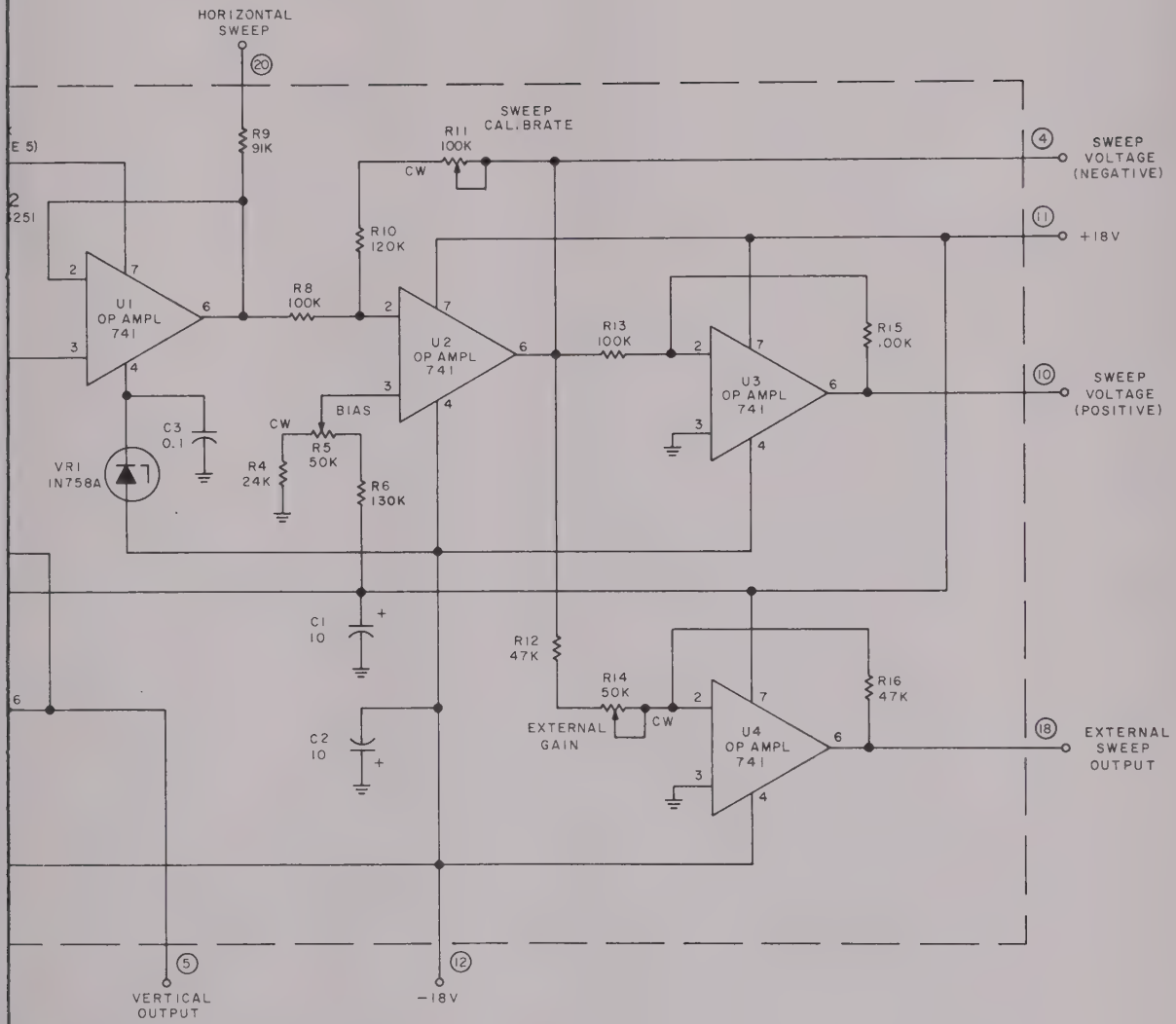
1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS MEASURED IN OHMS, ±5%
   b) CAPACITANCE IS MEASURED IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUM
3. CW ON POTENTIOMETERS INDICATES CLOCK
   ROTATION OF ACTUATOR.
4. FOR U1 THRU U5 LEAD ARRANGEMENT, SEE D

DETAIL A

BOTTOM VIEW

5 NOMINAL VALUE; FINAL VALUE FACTORY SELEC





%, 1/4W.

BERS.
VISE

ETAIL A.

TED.

Change 1
12/3/75

Figure 6-9. Type 8243 Sweep Generator (A8), Schematic Diagram

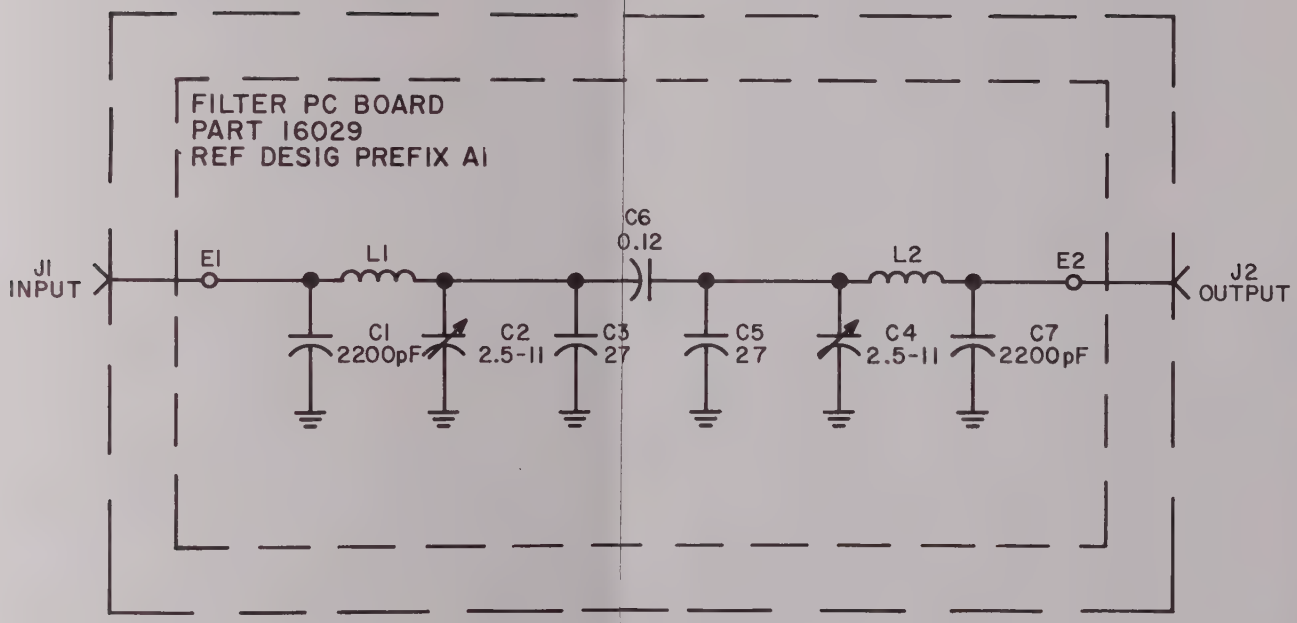
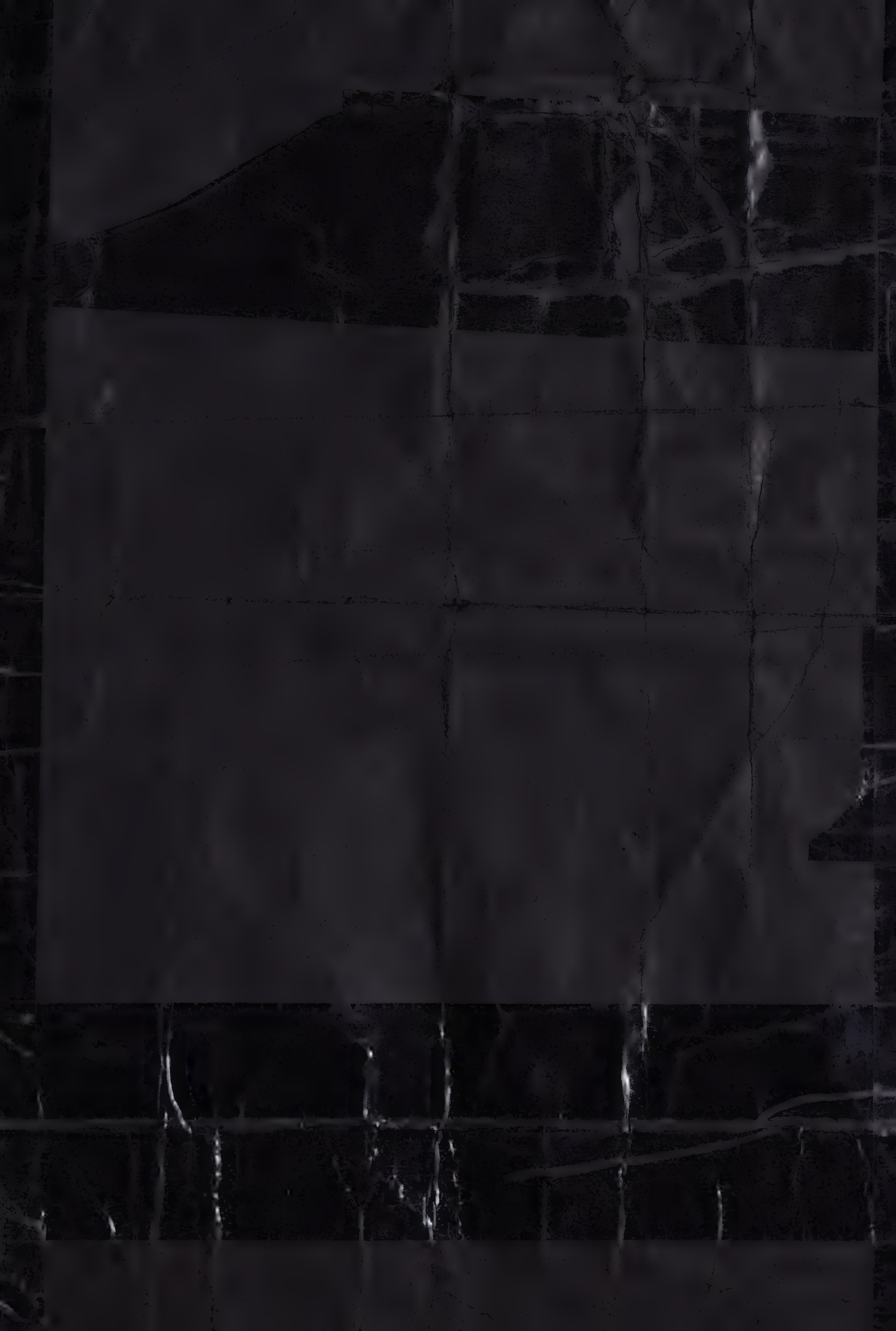
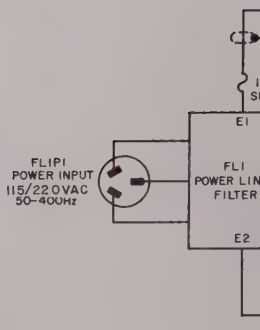
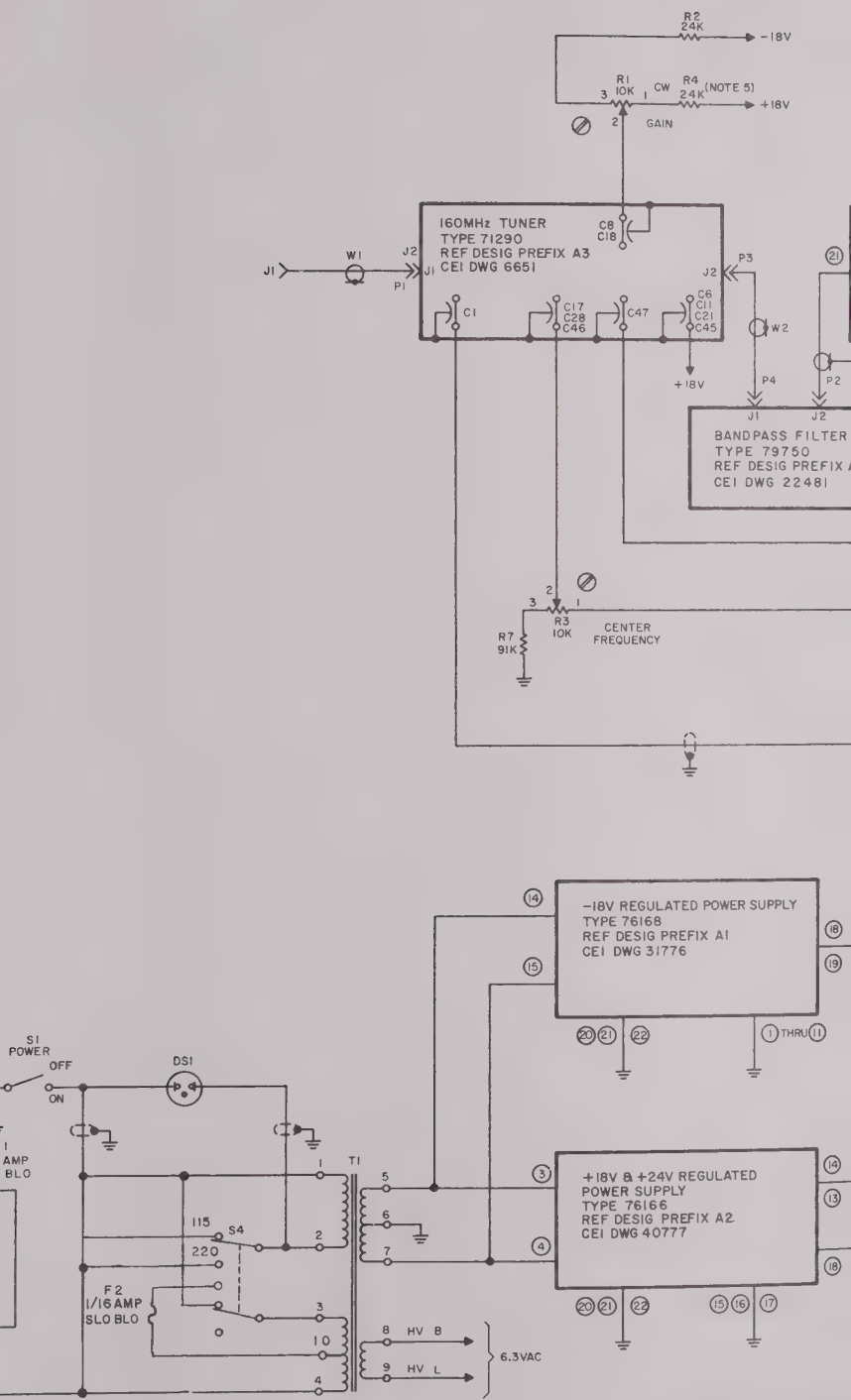


Figure 6-10. Type 79750 Bandpass Filter (A9), Schematic Diagram

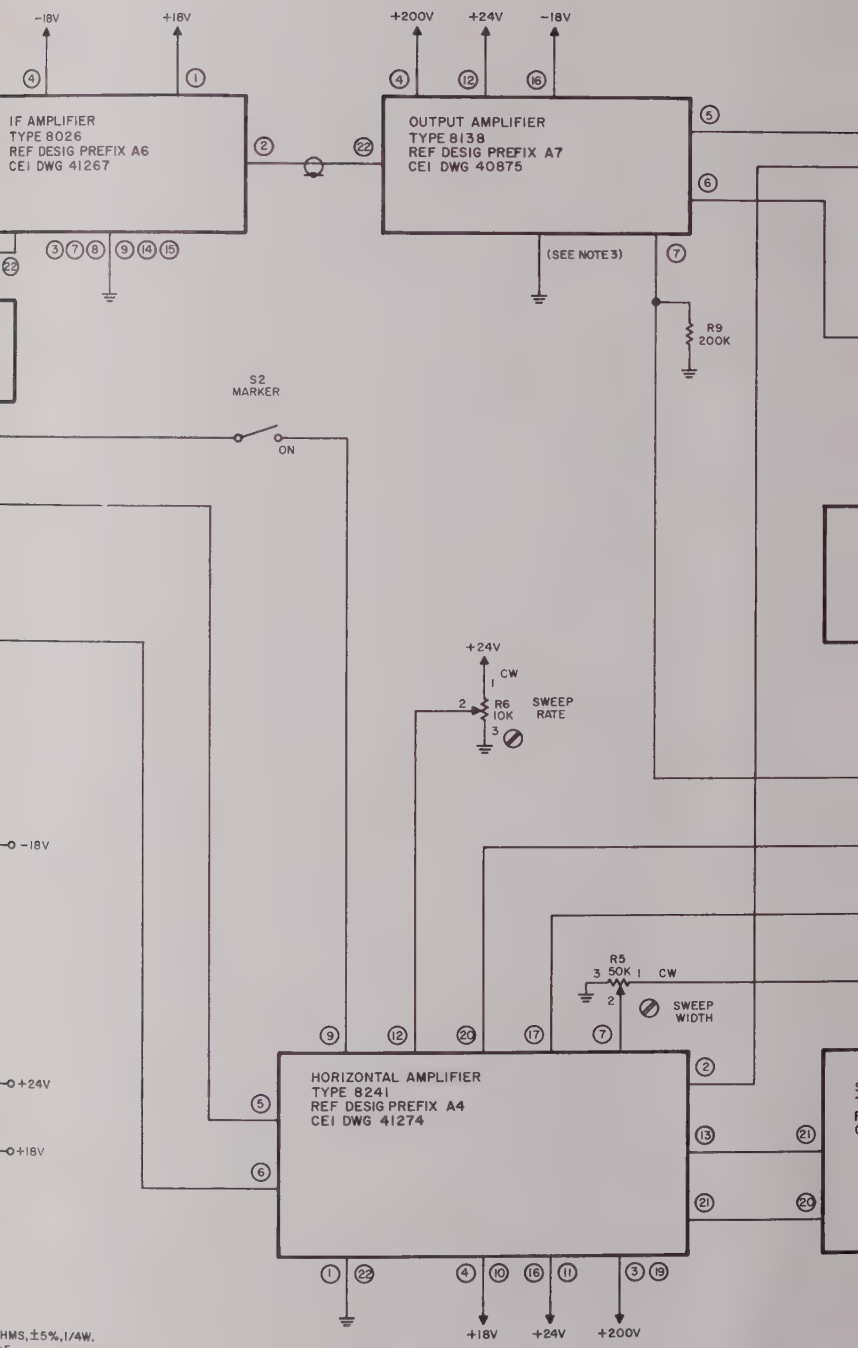



FL1P1
POWER INPUT
115/220VAC
50-400Hz
E1
E2



NOTES:

1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS MEASURED I
   b) CAPACITANCE IS MEASURED
2. ENCIRCLED NUMBERS ARE MOD
3. GROUND PINS FOR A7 ARE AS F
   1,2,8,9,10,11,13,14,15,19,20&21
4. THE FOLLOWING NOTATIONS AR
   a) CW INDICATES CLOCKWISE R
   b) ⊘ INDICATES SCREWDRIVE
5. NOMINAL VALUE. FINAL V
   SELECTED.
6. UNIT SHOWN WIRED FOR
   FOR 115/220V OPERAT
   FROM T1 PIN 10, AND

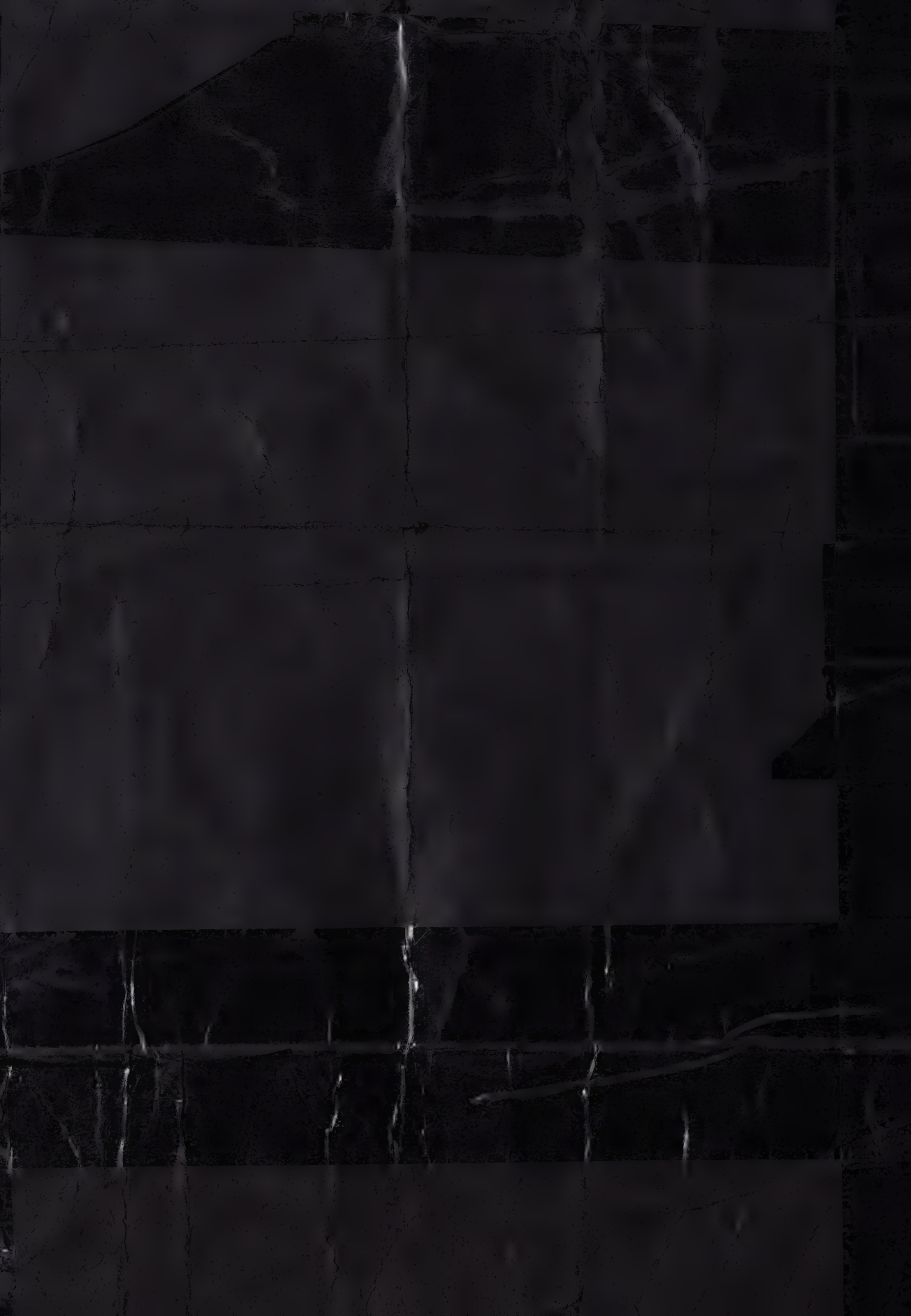


HMS, ±5%, 1/4W.
OF.
PIN NUMBERS.
LOWS:

SED ON POTENTIOMETERS:
TION.

UE TO BE FACTORY

15/220 V OPERATION;
, DISCONNECT FUSE F2
ONNECT IT TO T1 PIN 3.



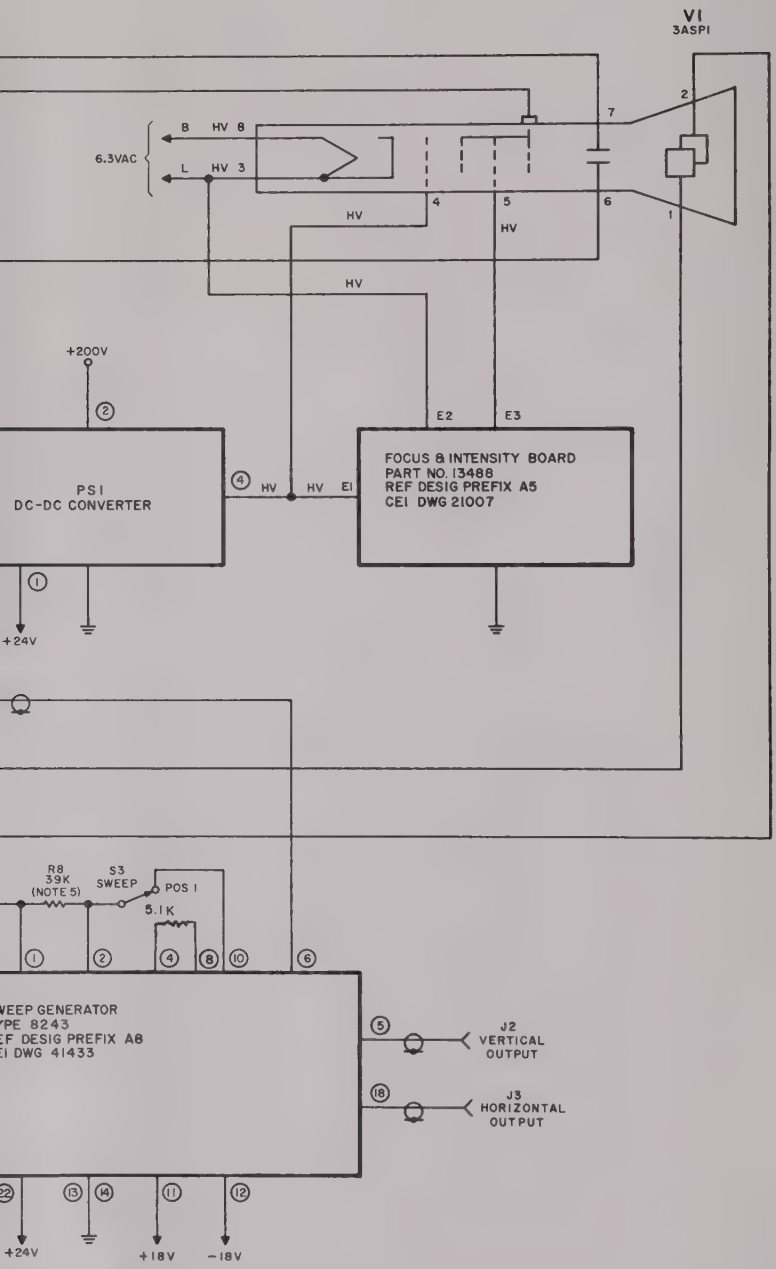


Figure 6-11. Types SM-1621 and SM-1622 Signal Monitors, Main Chassis Schematic Diagram

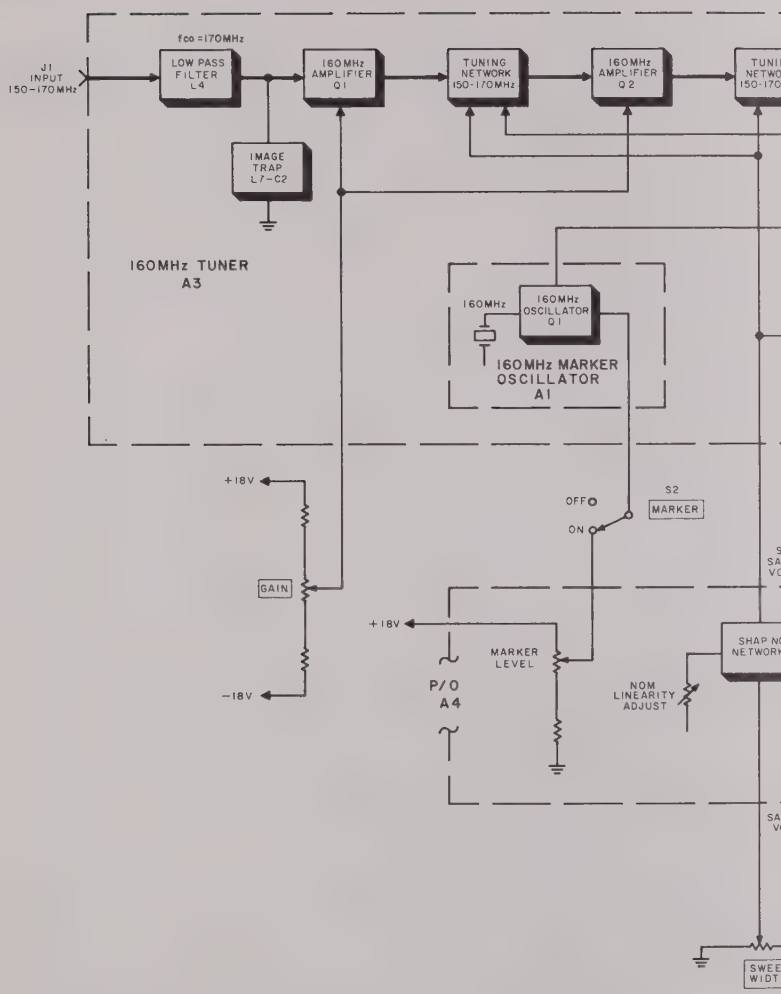
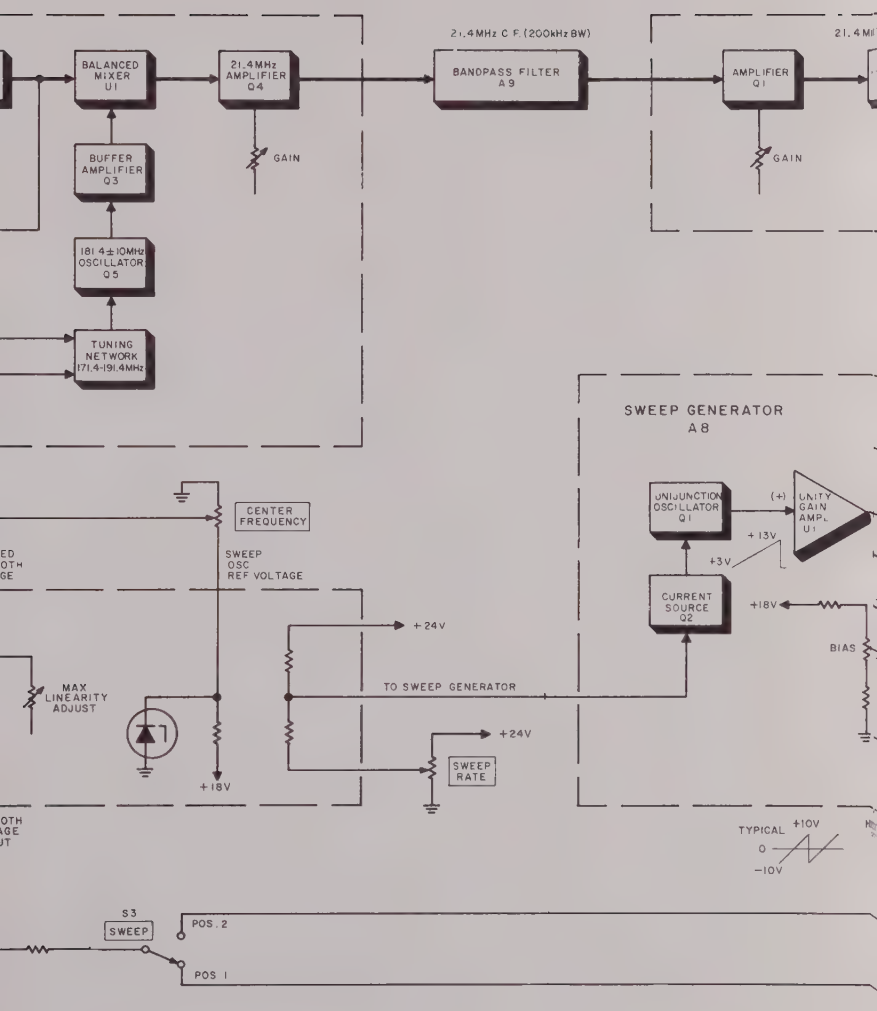
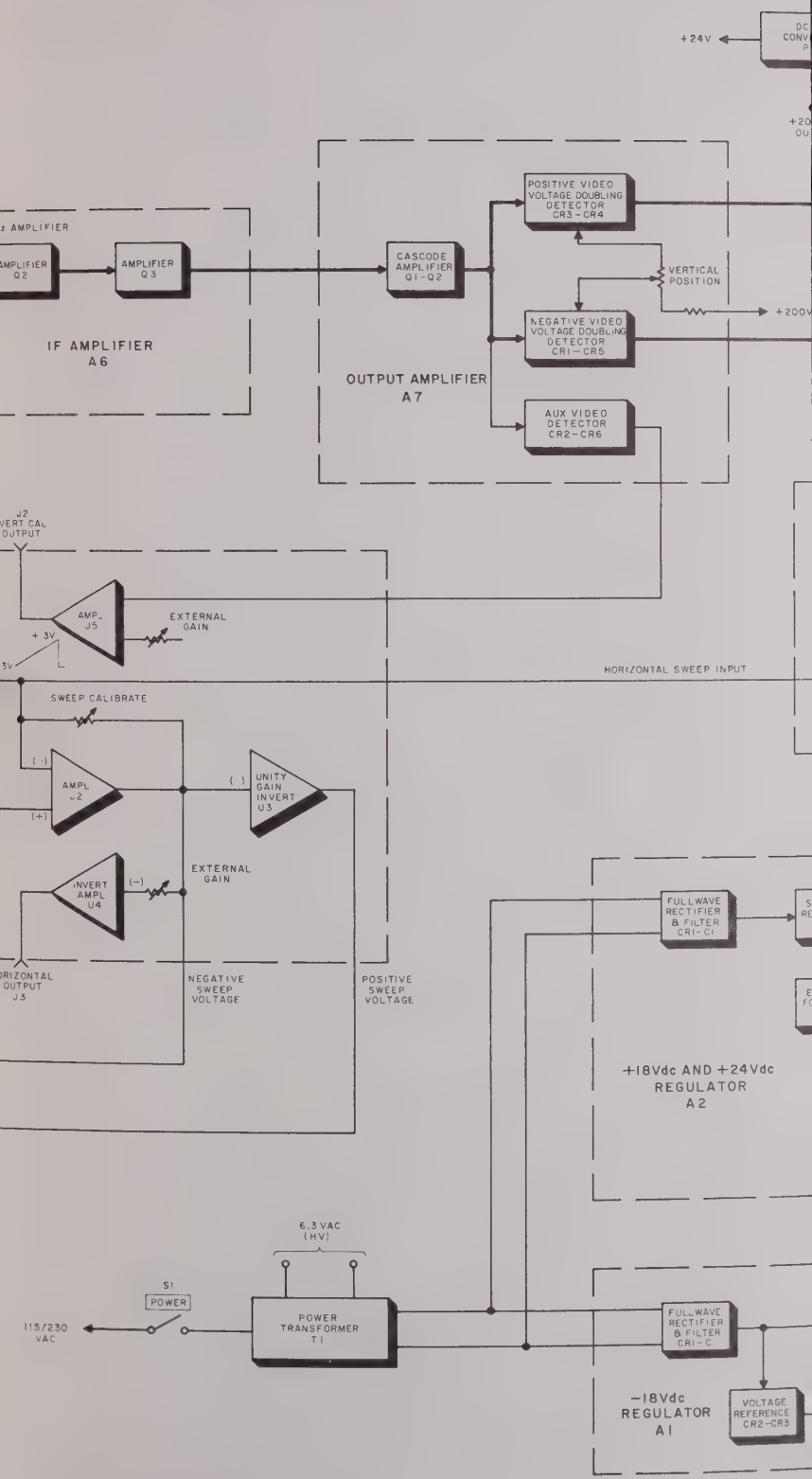
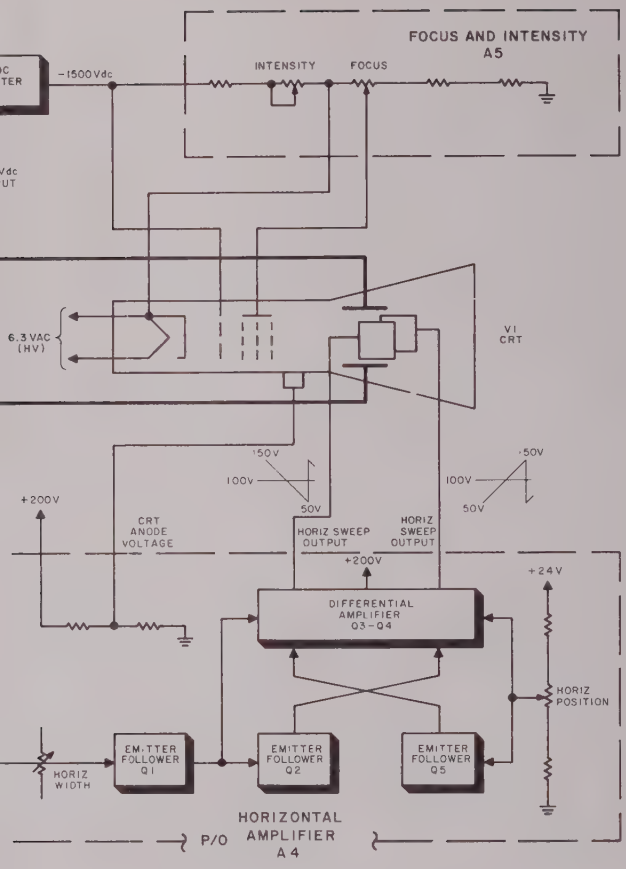
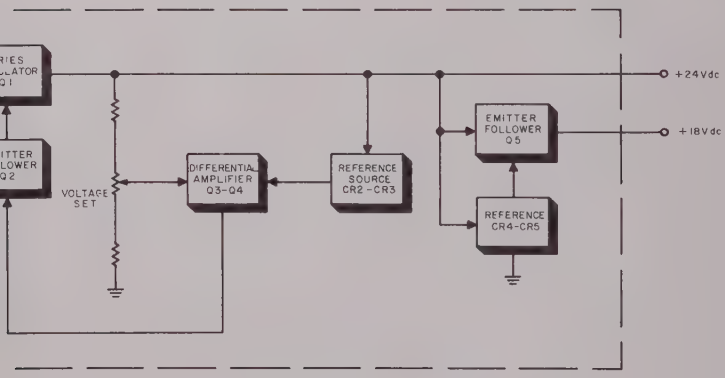


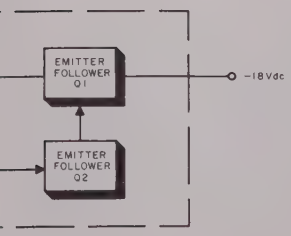
Figure 2-1. Types SM-1621 and SM-1622 Signal Monitors, Functional Block Diagram


21.4MHz C.F. (200kHz BW)
BALANCED MIXER U1
21.4MHz AMPLIFIER Q4
BANDPASS FILTER A9
AMPLIFIER Q1
GAIN
GAIN
BUFFER AMPLIFIER Q3
181.4±10MHz OSCILLATOR Q5
TUNING NETWORK 171.4-191.4MHz
SWEEP GENERATOR A8
UNIJUNCTION OSCILLATOR Q1
(+) UNITY GAIN AMPL U1
+13V
+3V
CURRENT SOURCE Q2
+18V
BIAS
CENTER FREQUENCY
SWEEP OSC REF VOLTAGE
+24V
TO SWEEP GENERATOR
MAX LINEARITY ADJUST
+24V
SWEEP RATE
+18V
TYPICAL
+10V
0
-10V
S3
SWEEP
POS. 2
POS. 1


+24V
AMPLIFIER
Q2
AMPLIFIER
Q3
IF AMPLIFIER
A6
CASCODE
AMPLIFIER
Q1-Q2
POSITIVE VIDEO
VOLTAGE DOUBLING
DETECTOR
CR3-CR4
VERTICAL
POSITION
NEGATIVE VIDEO
VOLTAGE DOUBLING
DETECTOR
CR1-CR5
AUX VIDEO
DETECTOR
CR2-CR6
OUTPUT AMPLIFIER
A7
AMP
J5
EXTERNAL
GAIN
+ 3V
HORIZONTAL SWEEP INPUT
SWEEP CALIBRATE
AMPL
U2
UNITY
GAIN
INVERT
U3
INVERT
AMPL
U4
EXTERNAL
GAIN
NEGATIVE
SWEEP
VOLTAGE
POSITIVE
SWEEP
VOLTAGE
FULLWAVE
RECTIFIER
& FILTER
CR1-C1
+18Vdc AND +24Vdc
REGULATOR
A2
6.3 VAC
(HV)
S1
POWER
115/230
VAC
POWER
TRANSFORMER
T1
FULLWAVE
RECTIFIER
& FILTER
CR1-C
-18Vdc
REGULATOR
A1
VOLTAGE
REFERENCE
CR2-CR3


FOCUS AND INTENSITY
A5
INTENSITY
FOCUS
-1500Vdc
6.3VAC
(HV)
V1
CRT
150V
100V
50V
+200V
CRT
ANODE
VOLTAGE
HORIZ SWEEP
OUTPUT
HORIZ
SWEEP
OUTPUT
+24V
DIFFERENTIAL
AMPLIFIER
Q3-Q4
HORIZ
POSITION
EMITTER
FOLLOWER
Q1
EMITTER
FOLLOWER
Q2
EMITTER
FOLLOWER
Q5
HORIZ
WIDTH
P/O
HORIZONTAL
AMPLIFIER
A4


+24Vdc
+18Vdc
EMITTER
FOLLOWER
Q5
VOLTAGE
SET
DIFFERENTIAL
AMPLIFIER
Q3-Q4
REFERENCE
SOURCE
CR2-CR3
REFERENCE
CR4-CR5


EMITTER
FOLLOWER
Q1
-18Vdc
EMITTER
FOLLOWER
Q2

MP MASTER
MA34477